TDI
Instructor Manual

Diver Standards

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Revision History

Revision Number	Date	Changes
2.0	11/12/2001	Reformatted
2.1	02/04/2002	1st Quarter 2002 Updates
2.2	10/10/2002	Updated with latest Training Updates.
3.0	08/15/2003	Updated with latest Training Updates.
3.1	12/19/2003	Editorial changes and minor updates.
5.0	11/19/2004	Minor updates.
6.0	10/13/2005	Major updates and additional standards added
7.0	10/27/2005	Editorial changes and training updates
8.0	11/13/2007	Updated with 2007 training updates. New standards.
9.0	12/01/2008	Updated with new standards and minor editorial changes
10.0	12/31/2009	Updated with 2009 training updates. Minor Edits.
11.0	01/01/2011	Major edits, minor updates
11.1	07/01/2011	Added Sidemount Standard and rEvo to the CCR Standards
12.0	01/01/2012	Added: DPV Diver #4 Helitrox Diver #10 Underwater Cave Surveying Diver Standard #20 DPV Cave Diver Standard #21 Stage Cave Diver Standard #22 KISS GEM Level 1 SCR Rebreather Standard #24 Minor edits
12.1	01/23/2012	Minor edits
12.2	02/15/2012	Added Instructor requirements to: DPV Diver Sidemount Diver Helitrox Diver
12.3	06/01/2012	2.3 Added Definitions
12.4	08/15/2012	Modified Poseidon MK VI / SE7EN Air Diluent CCR Diver #29 Added Poseidon Air Diluent Decompression Procedures Diver #30 and Poseidon Mixed Gas CCR Diver #31 Added Mine Diver I #23 and Mine Diver II #24
13.0	01/01/2013	# 32 MK VI / SE7EN Deco Procedures Diver Standard Changed the maximum depth for the MK VI / SE7EN to 40 metres / 130 feet to match Poseidon deco battery Added: Planning for bailout/deco OC gas requirements to the Dive Planning section Added: Use of the DSV/ADV for diluent flushes on the MK VI / Se7en to the Emergency Procedures section #33 MK VI / SE7EN Mixed Gas Diver Standard Revised the Prerequisites
13.1	04/01/2013	#2 Added Advanced Wreck to the list of courses that can be conducted using a CCR #34 Added Hollis Explorer Air Diluent CCR

13.2	07/01/2013	#25 Added Rebreather Discovery Program #27 Added Kiss GEM Sidekick Diver #30.6 Page 141 Clarified Crossover requirements #37 Added Rebreather Cavern Diver Standard #38 Added Rebreather Introductory Cave Diver Standard #39 Added Rebreather Full Cave Diver Standard
13.3	07/15/2013	Page 2 Removed requirement for student and instructor to be on the same unit when conducting courses using CCRs #5.11 Clarified requirements to become a TDI Sidemount Instructor Items 3.8, 5.9, 7.8, 8.8, 9.9, 10.8, 11.8, 12.8 and 13.8 Added Cue Cards and Evaluation Slate as optional material 17.8 Added *TDI Diving In Overhead Environments* manual as suggested reading material Items29.8, 30.8, 31.8, 32.8, 33.8, 34.8, 35.8, 36.8 and 39.8 Added TDI CCR Preflight check list and manufacturer's build checklist to required materials #32 Added Discovery MK VI / SE7EN to the Mixed Gas CCR Diver Standards. *Important Note: MK VI / SE7EN* ***MUST*** *be equipped with the full 60M Trimix upgrade.* #19.2 Page 83 Clarified requirements if decompression stops are conducted during course #19.5 Page 84 Clarified prerequisite ratings need if decompression stops are conducted during the course #31 Helitrox CCR Diver Unit Specific Standard #35.5 Page 171 Clarified the prerequisites for MK VI / SE7EN CCR Mixed Gas Diver
14.0	01/01/2014	No Changes
14.1	04/01/2014	Replace MK VI with MK VI / Se7en throughout Diver Standards 1.2 Rebreather Matrix updated 2.6 Clarified use of CCR's during TDI Diver courses
14.2	10/01/2014	Course Matrix-Updated depth of dives for Intro to Tech 29.5, 30.5 31.5 Added to perquisites: *If the rebreather is a TDI approved sidemount rebreather, the student must hold the TDI Sidemount Diver certification or equivalent and provide proof of 10 logged sidemount dives* *29.10, 30.11,31.11 Added to the Required Skill Performance and Graduation Requirements:* All standards set by both TDI and the rebreather manufacturer must be met, while maximum limits of neither may be exceeded *32 CCR Mixed Gas Diver completely revised* *33 CCR Advanced Mix Gas Diver completely revised* *29.8 Required Materials for Air Diluent CCR revised* *30.8 Required Materials for Air Diluent Decompression CCR revised* *31.8 Required Materials for Helitrox Decompression CCR revised*
15.0	01/01/2015	No Changes

1. Course Overview Matrix

1.1 All Courses

Section	Course	Minimum Age	Number of Required Dives	Student to Instructor Ratio	Prerequisite Certification and dives
3	Intro to Tech	15	3 dives no deeper than 23 metres / 75 feet	6 to 1	Advanced Diver 25 logged dives
4	DPV Diver	18	3 dives	4 to 1	Open Water Diver
5	Sidemount Diver	18	3 dives	4 to 1	Open Water Diver
6	Nitrox Diver	15	N/A 2 dives recommended	N/A 8 to 1	SDI Open Water Scuba Diver or current enrollment in an SDI Open water Scuba Diver course or equivalent
7	Advanced Nitrox	15	4 dives 100 minutes bottom time	8 to 1	Nitrox diver 25 logged dives
8	Decompression Procedures Diver	18	4 dives	4 to 1	Advanced Adventure Diver or Advanced Diver and 25 logged dives
9	Extended Range Diver	18	4 dives All dives greater than 33 metres / 100 feet 2 dives greater than 40 metres / 130 feet	4 to 1	Advanced Nitrox and Decompression Procedures certifications
10	Helitrox Diver	18	4 dives 2 dives greater than 30 metres / 100 feet	4 to 1	Advanced Diver with Deep Specialty or TDI Intro to Tech Diver, Advanced Nitrox Diver 50 logged dives
11	Advanced Wreck Diver	18	6 dives all penetration 100 minutes bottom time	4 to 1	Advanced diver Basic wreck diver or cavern 50 logged dives

12	Trimix Diver	18	4 dives 2 greater than 40 metres / 130 feet 100 minutes bottom time	4 to 1	Decompression procedures and advanced nitrox certifications
13	Advanced Trimix Diver	18	4 dives 2 greater than 55 metres / 180 feet 100 minutes bottom time	4 to 1	Extended range diver or entry level trimix diver 100 logged dives
14	Nitrox Gas Blender	18	N/A	N/A	None
15	Advanced Gas Blender	18	N/A	N/A	TDI Gas Blender or equivalent
16	Oxygen (O_2) Equipment Service Technician	18	N/A	N/A	TDI Gas Blender or equivalent General equipment technician Employed at a scuba related facility
17	Cavern Diver	15	4 dives and 80 minutes bottom time at 2 different sites	4 to 1	Open water diver 25 logged dives
18	Introductory to Cave Diver	15	4 dives with limited penetration 80 minutes bottom time at 2 different locations	3 to 1	Cavern diver
19	Full Cave Diver	18	8 dives 240 minutes bottom time	3 to 1	Introductory cave diver
20	Underwater Cave Surveying Diver	18	2 dives for a minimum of 60 minutes	2 to 1	Full Cave Diver, 25 non-training full cave dives
21	DPV Cave Diver	18	3 dives at 2 different locations for a minimum of 90 minutes	2 to 1	Full Cave diver, Decompression Procedures diver, 50 non-training full cave dives
22	Stage Cave Diver	18	3 dives at 2 different locations for a minimum of 90 minutes	3 to 1	Full Cave diver
23	Mine Diver I	18	4 dives for minimum 100 minutes If combined with Mine Diver I1-12 dives for a minimum of 340 minutes over 6 days	3 to 1	TDI Cavern Diver or equivalent

24	Mine Diver II	18	8 dives for minimum 240 minutes If combined with Mine Diver 1-12 dives for a minimum of 340 minutes over 6 days	3 to 1	TDI Mine Diver 1
25	Rebreather Discovery	18	1 pool/confined water session for minimum 30 minutes to a maximum depth of 9 metres / 30 feet 1 Open water session is optional	1 to 1	TDI Nitrox Diver or equivalent 10 logged dives to participate in pool/confined session 25 logged dives to participate in open water session
26	Semi-Closed Rebreather Diver	15	4 dives 100 minutes bottom time for Dolphin 6 dives for the Azimuth	6 to 1	Basic nitrox or current enrollment in a basic nitrox course
27	KISS GEM Level 1 Rebreather Diver	18	Minimum of 60 minutes in confined water Minimum 5 dives Minimum 200 bottom time in open water 2 dives deeper than 15 metres / 50 feet	4 to 1	Nitrox Diver and Advanced Diver at the discretion of the instructor
28	GEM Sidekick	18	Minimum of 60 minutes in confined water Minimum 5 dives Minimum 200 bottom time in open water 2 dives deeper than 15 metres / 50 feet	4 to 1	SDI Advanced Diver or equivalent, SDI or TDI Nitrox Diver or equivalent (May be combined)
29	Air Diluent Closed Circuit Rebreather Diver	18	Minimum of 60 minutes in confined water Minimum 7 dives Minimum 420 bottom time in open water Maximum depth 30 metres / 100 feet	2 to 1	Nitrox diver (may be combined with program) 20 logged dives

30	Air Diluent Closed Circuit Rebreather Decompression Procedures Diver	18	Minimum of 60 minutes in confined water Minimum 7 dives Minimum 420 bottom time in open water Maximum depth 45 metres / 150 feet	2 to 1	Advanced Nitrox and Decompression Procedures diver 50 logged dives
31	Helitrox Closed Circuit Rebreather Diver	18	Minimum time in confined water is 60 minutes 7 dives for a minimum time of 420 minutes Gradually increasing depth to a maximum depth of 45 metres / 150 feet	4 to 1	50 logged dives TDI Advanced Nitrox, Deco Procedures or Helitrox Diver or the equivalent OR TDI Air Dil Diver with 30 hours on the unit and 6 months CCR diving
32	Mixed Gas Closed Circuit Rebreather Diver	18	6 dives deeper than 40 metres / 130 feet 8 dives if combined with trimix diver	2 to 1	TDI Air Diluent CCR diver or equivalent from an agency recognized by TDI TDI Trimix diver (may be combined with program) 50 rebreather hours over 50 logged dives on a specific unit
33	Advanced Mix Gas Closed Circuit Rebreather Diver	18	7 dives 5 of the mixed gas dives must be decompression dives	2 to 1	TDI Mixed Gas Diluent CCR diver or equivalent from an agency recognized by TDI 100 CCR hours over 100 on a specific unit 50 percent of the dives must be deeper than 30 metres / 100 feet

34	Air Diluent Closed Circuit Rebreather Diver Unit Specific Poseidon Discovery MK VI / SE7EN	18	Minimum of 60 minutes in confined water Minimum 4 dives Minimum 180 bottom time in open water Maximum depth 30 metres / 100 feet	4 to 1	Nitrox diver 20 logged dives
35	Air Diluent Decompression Procedures Closed Circuit Rebreather Diver Unit Specific Poseidon Discovery MK VI / SE7EN	18	Minimum of 60 minutes in confined water maximum depth 9 metres / 30 feet Minimum 7 dives Minimum 420 bottom time in open water Maximum depth 45 metres / 150 feet	4 to 1	MK VI / SE7EN Diver Advanced Nitrox and Decompression Procedures Open Circuit Diver 50 Logged dives
36	Mixed Gas Closed Circuit Rebreather Diver Unit Specific Poseidon Discovery MK VI / SE7EN	21	Minimum 360 minutes in open water maximum depth 40 metres / 130 feet Minimum 6 dives 4 dives must be decompression dives	2 to 1	MK VI / SE7EN Decompression Procedures Diver
37	Air Diluent Closed Circuit Rebreather Diver Unit Specific Hollis Explorer	18, 15 with parental consent	4 dives with a minimum of 100 minutes accumulated	6 to 1	TDI Nitrox Diver, or equivalent 25 logged dives, Less than 25 logged dives a 60 minute confined water session is required

38	Rebreather Cavern Diver	18	5 dives must be conducted 4 cavern dives with a minimum of 120 minutes conducted at 2 different locations	3 to 1	TDI Air Diluent CCR diver on specific unit 25 logged dives and 25 hours on specific unit
39	Rebreather Introductory Cave Diver	18	1 open water evaluation dive must be conducted if student is new to the instructor or it has been more than 6 months since last cavern dive 4 single guideline cave dives with a total bottom time of 120 minutes at 2 different locations	3 to 1	TDI CCR Air Diluent Diver or the equivalent TDI Rebreather Cavern Diver or equivalent OR TDI Introductory Diver or equivalent 50 logged dives and 30 hours on the specific unit
40	Rebreather Full Cave Diver	18	8 cave dives with a minimum accumulated bottom time of 360 minutes at 3 different locations 1 site not used during the cavern or introductory cave courses At least 2 dives must be at least 60 minutes long	3 to 1	TDI CCR Air Diluent Decompression Procedures Diver or equivalent TDI Rebreather Introductory to Cave Diver Or TDI Full Cave Diver certification 50 logged dives and 50 hours on specific unit

1.2 Rebreather Training Courses

TDI offers training on the following CCR Units

Unit	Air Diluent	Air Diluent Decompression	Helitrox	Mixed Gas	Advanced Mixed Gas
Copis	√	√	√	√	√
Discovery MK VI / Se7en	√	√	_	√	--
Evolution	√	√	√	√	√
Hammerhead	√	√	√	√	√
Hollis Explorer	√	--	--	--	--
Inspiration	√	√	√	√	√
KISS	√	√	√	√	√
Mark 15	√	√	√	√	√
Megalodon	√	√	√	√	√
Optima	√	√	√	√	√
Ouroboros	√	√	√	√	√
Pathfinder	√	√	√	√	--
Prism Topaz / Prism2	√	√	√	√	√
Pelagian	√	√	√	√	√
rEvo	√	√	√	√	√
Sentinel	√	√	√	√	√
SF2	√	√	√	√	√
Submatix 100	√	√	√	√	√
Titan	√	√	√	√	√

The air diluent, air diluent decompression procedures, mixed gas and advanced mixed gas CCR diver course standards contained in this manual are unit specific to the above CCRs .

2. General Course Standards

These standards apply to all TDI Diver Courses and Specialties

2.1 Administrative

Instructors must ensure that all students complete the following forms for each course and specialty the student participates in.

1. *TDI Liability Release and Express Assumption of Risk* Form
2. *TDI Medical Release* Form

If a student writes a yes to any question in the medical release Form under the section marked "Have you ever had a history of or do you currently have" then the student must provide written permission from a doctor before participating in confined or open water training or any course or specialty training.

3. TDI Diver Registration Form or register the student online in the member's section of the TDI website (upon completion of the specified course)
4. TDI Diver Training Record; these training records must be kept for a minimum of 7 years
5. All courses must be completed in 12 months

2.2 Accidents

Hopefully a member will never have to do this, however, if a member, were involved in an accident or simply witnessed an accident the TDI Accident Report Form must be completed by the member/witness, and faxed to TDI Headquarters immediately after the accident happened.

2.3 Definitions

Assistant or Assisted by = A person who is assisting a primary and certified instructor, IT staff instructor or instructor trainer for a course that they, the "assistant", is not certified to teach. Assistants can be used for the purposes of additional supervision and to increase ratios where standards and environmental conditions allow. Assistants listed on registrations will receive experience credits for courses they have assisted with only if listed on the initial registration form.

Co-Teach or 2nd Instructor = A person who is certified to teach the course taking place and is working together with an also certified instructor, IT staff instructor or instructor trainer. The 2nd instructor will receive equal credit for the course if listed on the initial registration form.

2.4 Confined Water Training

Confined water training must be conducted in a swimming pool or a confined body of water with the following conditions:

6. Approximately 3 metres / 10 feet of visibility
7. Calm surface conditions
8. Easy access to depths that allow students to stand with their head above water
9. Depths that allow skills to be adequately demonstrated

10. Equipment appropriate for the training site
11. Confined water training sites other than pools, must be approved by TDI Headquarters

2.5 Open Water Training

The instructor, with the following considerations, must carefully choose an open water training site:

1. Body of water similar to the regional diving conditions (ocean, lake, etc.)
   Note; swimming pools are not considered an open water environment
2. Water clarity
3. Temperature above and below the water
4. Weather conditions
5. Water access
6. Equipment adequate for the conditions
7. Thermal protection appropriate for the conditions
8. A complete briefing that includes:
   a. The dive site
   b. Water conditions
   c. Skills to be performed
   d. Entry/Exit to be used
   e. Emergency procedures
9. A complete debriefing that includes:
   a. Performance of divers as a whole
   b. Areas that need improvement
   c. Environmental observations
   d. Question and answers

2.6 Conducting Courses Using Closed Circuit Rebreather (CCR)

The following TDI Diver level courses may be conducted using CCR subject to the requirements below:

Advanced Nitrox, Advance Wreck, Cavern, Introductory Cave, Full Cave, Mine Diver Level 1 and 2

1. Course student(s) must meet all course prerequisites and be fully certified on the CCR unit being used (Unless combining advanced nitrox training with CCR training)
2. Course instructor(s) must be a TDI Instructor for the CCR unit being used

Note: Cylinder capacities used in the TDI Standards are based on manufacturer values or generalized conversions and are NOT exact conversions from metric to imperial due to variance in cylinder volume and working pressures. If you use metric cylinders, please use the metric size cylinder listed; likewise, if you use imperial cylinders, please use the imperial size cylinder listed, I.E. 3 litres / 18 cubic ft.

3. Intro to Tech

3.1 Introduction

The TDI Intro to Tech course introduces students to the world of technical diving. This course is designed as an introductory course to the TDI Advanced Nitrox course and the TDI Decompression Procedures Course. The objective of this course is to familiarize students with technical equipment configurations, to enhance open water diving skills (such as buoyancy, trim, and situational awareness), and to introduce students to advanced gas planning techniques within a no-decompression context. This course is strictly a no-decompression course; students are permitted to use enriched air nitrox (EAN) mixes, provided the gas mix is within their current level of certification. Intro to Tech may be combined with TDI Advanced Nitrox at the discretion of the instructor.

3.2 Qualifications of Graduates

Upon successful completion of the course, graduates may engage in diving activities in a technical equipment configuration without direct supervision provided:

1. The diving activities approximate those of training
2. The areas of activities and environmental conditions approximate those of training

Graduates may enroll in:

3. TDI Advanced Nitrox Course
4. TDI Decompression Procedures Course

3.3 Who May Teach

1. **Procedure One**
   A current and active status SDI Open Water Scuba Diver Instructor or TDI Nitrox Instructor who has completed a TDI Intro to Tech Instructor course conducted by a TDI Intro to Tech IT may be registered to teach.
2. **Procedure Two**
   An active status SDI Open Water Scuba Diver Instructor or TDI Nitrox Instructor who holds the ratings of TDI Advanced Nitrox and Decompression Procedures Diver certifications, or equivalent, may apply for an administrative upgrade to teach

3.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 6 students per instructor; it is the instructor's discretion to further reduce this number as conditions dictate

3.5 Student Prerequisites

1. Minimum age 18, 15 with parental consent
2. Minimum certification an SDI Open Water Scuba Diver or equivalent
3. Provide proof of 25 logged open water dives

3.6 Course Structure and Duration

Open Water Execution

1. A minimum of 3 dives must be conducted; All dives must be conducted at depths within the diver's current level of certification but no dives should exceed 23 metres / 75 feet
2. If the TDI Intro to Tech is taught in conjunction with Advanced Nitrox, only a total of 4 dives are required; more may be conducted at the discretion of the instructor

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 6

3.7 Administrative Requirements

Administrative Tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

3.8 Training Material

Required material;

1. *TDI Intro to Tech* Manual
2. *TDI Intro to Tech* PowerPoint Presentation
3. *TDI Intro to Tech* Instructor Guide

4. *TDI Intro to Tech* Instructor Resource CD

Optional material;

1. *TDI Advanced Nitrox Diving* Manual
2. *TDI Decompression Procedures* Manual
3. *TDI Intro To Tech Cue Cards*
4. *TDI Intro To Tech Evaluation Slate*

3.9 Required Equipment

The following equipment is required for this course:

1. Primary cylinder(s) cylinder volume appropriate for diving conditions and diver gas consumption
2. Primary regulators
    a. Primary and alternate second stage required on all primary cylinder(s)
    b. Submersible pressure gauges are required on all primary cylinder(s)
3. Depth gauge and automatic bottom timer and/or dive computer
4. Buoyancy compensator device appropriate for equipment configuration
5. Ascent reel with lift bag/surface marker buoy
    a. Appropriate for maximum planned depth
    b. Lift bag with at least 11 kg / 25 lbs of lift
6. Exposure protection appropriate for local diving condition
7. Slates / wet-notes

3.10 Required Subject Areas

Instructors may use any materials they feel help in the presentation of the required subject areas. The following topics must be covered during the course:

1. Physics
    a. Pressure review
2. Physiology
    a. Ascent/descent rates
    b. Hyperthermia
    c. Hypothermia
    d. Psychological aspects
3. Equipment Considerations
    a. Single/double cylinder(s); valve options
    b. Regulator options
    c. Harness/BCD options
    d. Computer, bottom timer, depth gauge options
    e. Reels/spools options
    f. Lift bag/surface marker bag options

g. Exposure protection options
h. Minimum equipment, bring only what is needed
i. Stream lining and stowing equipment

4. Dive Planning
    a. Tables/computer dive planning and execution
    b. Surface air consumption (SAC) rate calculations
    c. Minimum gas reserve calculations for no-decompression dives
    d. Environmental considerations
5. Procedures
    a. Entry/exit strategies
    b. Emergency strategies in case of gas failure/loss
    c. Ascent/descent strategies

3.11 Required Skill Performance and Graduation Requirements

Students are required to successfully complete the following open water skills:

Land drills:

1. Selection and preparation of equipment
2. Conduct team oriented skills (buddy checks) for lift bag deployment
3. Gas matching among buddy teams
4. Demonstrate familiarity with basic hand signals
5. Demonstrate adequate pre-dive planning with limits based on the team and personal gas consumption

Pre-dive drills:

1. Use S.T.A.R.T. before every dive
2. Stress analysis and mitigation

***START is S-drill (OOA drill and Bubble Check), Team (buddy equipment checks), Air (gas matching), Route (entry/exit and planned path underwater), Tables (depth, duration, waypoints and schedule).**

In-water drills:

1. Weight check
2. Demonstrate adequate buoyancy control (ability to hover at fixed position in water column without moving hands or feet)
3. Demonstrate adequate trim (ability to maintain horizontal during the descent, bottom and ascent portion of the dive)
4. Demonstrate no-silting propulsion techniques: frog kick, modified frog kick, modified flutter kick, backwards kick
5. Demonstrate the ability to perform the following exercises while maintaining trim and buoyancy in the water column:
    a. Regulator exchange
    b. Regulator recovery
    c. Mask partial flood and clear with minimal air loss

d. Mask removal and clear with minimal air loss

6. Demonstrate the ability to perform a safety drill (S-drill) while maintaining trim and buoyancy in the water column
7. Demonstrate the ability to perform a valve drill while maintaining trim and buoyancy in the water column (if double cylinders are being used)
8. Demonstrate the ability to deploy a surface marker buoy or lift bag while maintaining trim and buoyancy in the water column
9. Show good situational awareness

In order to complete this course, students must:

1. Complete all open water requirements safely and efficiently
2. Demonstrate mature, sound judgment concerning dive planning and execution

4. DPV Diver

4.1 Introduction

The purpose of the TDI Diver Propulsion Vehicle (DPV) course is to familiarize divers with the skills, knowledge, planning, organization, procedures, techniques, problems, and hazards of using DPVS. Upon completing the TDI Diver Propulsion Vehicle Specialty training, the student should be able to: demonstrate comprehension of the practical knowledge necessary for DPV diving, properly plan and safely conduct DPV dives, and implement techniques and procedures to manage and minimize DPV diving hazards.

4.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in DPV diving activities without direct supervision so long as the following limits are adhered to:

1. Safety and decompression stops as appropriate or necessary
2. Planned dives do not exceed diver's current certification level

4.3 Who May Teach

3. An active TDI DPV Instructor.

4.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to insure comprehensive and complete training of subject matter.

Confined Water (swimming pool-like conditions)

1. NA

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 3 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate.

4.5 Student Prerequisites

1. Minimum age 18, 15 with parental consent
2. Certified as an SDI Open Water Scuba Diver or equivalent
3. Provide proof of at least 25 logged dives

4.6 Course Structure and Duration

Open Water Execution

1. Students must complete 2 DPV dives with a minimum accumulated bottom time of 60 minutes.

2. Dives must not exceed 40 metres / 130 feet

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 4

4.7 Administrative Requirements

Administrative Tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

4.8 Required Equipment

The following material is required:

1. NA

The following equipment is required for each student:

1. Cylinder(s), volume appropriate for planned dive, student gas consumption
2. First and second stage regulator(s) with alternate air source;
3. Submersible pressure gauge
4. Buoyancy compensator device (BCD) with power inflator
5. Exposure suit adequate for diving environment
6. Mask and fins
7. Cutting device
8. Computer, watch or bottom timer and depth gauge
9. Slate or wet notes with a pencil
10. Whistle or other signaling device
11. DPV adequately configured for the environment
12. Reel with a minimum of 7.5 metres / 25 feet of line
13. Lift bag or surface marker buoy with a minimum of 12 kgs / 25 lbs of lift
14. Compass

4.9 Required Subject Areas

The following topics must be covered during this course:

1. Motivations for DPV diving
2. Advantages of DPV use
3. Equipment considerations
    a. DPV options
    b. DPV components
    c. Rated burn time
    d. Care and Maintenance
    e. DPV rigging
4. Problem solving procedures
    a. DPV malfunction or failure
    b. Towing
    c. Gas sharing with DPVs
    d. Entanglement
    e. Collision avoidance
    f. Team separation
5. Environmental considerations
    a. Appropriate vs. inappropriate dive locations
    b. Suitable environmental conditions
    c. Low impact DPV use
6. DPV diving techniques
    a. Buoyancy and trim with DPV
    b. Instigating directional and depth changes
    c. DPV "parking"
    d. DPV courtesy and etiquette
7. Dive planning and gas management
    a. Turn time, turn distance, and turn pressure
    b. Gas mix(es) and NDLs or decompression obligations

4.10 Required Skill Performance and Graduation Requirements

The student must perform the following S-drill and skills during all dives:

1. Demonstrate adequate pre-dive planning
2. Equipment check and equipment matching
3. Bubble check
4. Demonstrate specialized propulsion techniques in varying types of flow
5. Demonstrate proper buoyancy control
6. Demonstrate proper body posture
7. Demonstrate proper stress analysis (detection and management)

The student must perform the following in-water skills during cave dives:

1. Proper use of DPV
2. Gas sharing ascent with DPVs clipped off.
3. Ascent with a disabled DPV
4. Tow a team member and his disabled DPV

In order to complete this course, students must:

1. Perform all dive requirements safely and efficiently
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Maintain an appropriate level of awareness and respect for the cavern environment
4. Log all dives

4.11 To qualify to teach the TDI DPV Diver Course an Instructor must:

1. Be an active TDI Instructor
2. Provide proof of 25 logged DPV technical dives *

*** Technical Dive; Any dive involving decompression, additional cylinders, overhead environments such as wrecks, caves or mines.**

5. Sidemount Diver

5.1 Introduction

This course is designed to teach certified divers how to safely utilize side-mounted primary cylinders as an alternative to the traditional back-mounted configuration. This course can be combined with other TDI courses such as: Decompression Procedures, Extended Range, Trimix, Advanced Trimix and Advanced Wreck. If combined the standards for both courses must be met.

5.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in sidemount diving activities without direct supervision so long as the following limits are adhered to

1. Safety and decompression stops as appropriate or necessary.
2. Planned dives do not exceed diver's current certification level.

5.3 Who May Teach

1. This course may be taught by any active TDI Sidemount Diving Instructor.

5.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter.

Confined Water (swimming pool-like conditions)

1. N/A

Open Water Dives

1. A maximum of 4 students per instructor is allowed

5.5 Student Prerequisites

1. Minimum age 18
2. Minimum certification; SDI Open Water Scuba Diver or the equivalent

5.6 Course Structure and Duration

Water execution

1. Three dives are required with a minimum accumulated bottom time of 90 minutes

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The suggested number of classroom and briefing hours is 4
2. Course must be taught over a minimum of 2 days

5.7 Administrative Requirements

Administrative Tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

5.8 Required Equipment

The following equipment is required for each student:

1. Dual cylinders, volume appropriate for planned dive, and student gas consumption
2. Two independent first and second stage regulators each with a submersible pressure gauge
3. Buoyancy compensator device (BCD) with power inflator appropriate for sidemount configuration
4. Exposure suit adequate for diving environment
5. Mask and fins
6. Dive computer and a additional depth and timing device; backup computer recommended

Instructor must wear full sidemount diving equipment during all water exercises

5.9 Required Subject Areas

Instructors may use any text or materials that they feel help present these topics.

Optional Materials:

1. *TDI Sidemount Cue Cards*
2. *TDI Sidemount Evaluation Slate*

The following topics must be covered during this course:

1. Gas matching procedures to include dissimilar volumes
2. Gas management utilizing independent cylinders

3. Psychological considerations
4. Equipment considerations
    a. Cylinder options
    b. Regulator options
    c. Buoyancy compensator / harness options
    d. Proper weighting
    e. Equipment configurations
5. Communication
    a. Hand signals
    b. Light signals
6. Problem solving
    a. Gas-sharing
    b. Gas hemorrhages
    c. Light failure
    d. Loss of visibility
    e. Entanglement
    f. Self rescue
7. Tight spaces
8. Conservation
9. Difficult water entries
10. S-Drills; specific to sidemount

5.10 Required Skill Performance and Graduation Requirements

The following land drills must be covered during this course:

1. Land drills may be performed at the instructor's discretion

Pre-dive drills:

1. Use START before every dive *START is an acronym for S-drill (Out of Gas drill and Bubble Check), Team (buddy equipment checks), Air (gas matching), Route (entry/exit and planned path underwater, Tables (depth, duration, waypoints and schedule)
2. Stress analysis and mitigation

The student must perform the following in-water skills during dives:

1. Demonstrate various propulsion techniques: frog kick, modified frog kick, modified flutter kick, backwards kick, helicopter turns, and hand pulling if appropriate for the environment
2. Demonstrate adequate buoyancy control; ability to hover at fixed position in water column without moving hands or feet
3. Demonstrate adequate trim; ability to maintain proper position during the descent, bottom and ascent portion of the dive
4. Demonstrate the ability to perform the following exercises while maintaining trim and buoyancy in the water column:

   a. Unclipping and attaching sidemount cylinders
   b. Perform gas switches with and without a mask
5. Demonstrate the ability to safely manage gas in independent cylinders
6. Demonstrate conservation, awareness, and back referencing techniques
7. Deploy lift bag
8. Carry additional cylinder(s); optional

In order to complete this course, students must:

1. Perform all land drills and dive requirements safely and efficiently
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Maintain an appropriate level of awareness and respect for the environment
4. Log all dives

5.11 To qualify to teach the TDI Sidemount Diver Course an Instructor must:

1. Be an active TDI Instructor
2. Provide proof of 25 logged sidemount technical dives *

OR

1. Be certified as a sidemount diver
2. Provide proof of 10 technical sidemount dives*
3. Complete the course with an active TDI Sidemount IT

*** Technical Dive; Any dive involving decompression, additional cylinders, overhead environments such as wrecks, caves or mines.**

6. Nitrox Diver

6.1 Introduction

This is the entry-level certification course for recreational divers wishing to utilize enriched air nitrox (EAN) as a breathing gas. The objective of this course is to train divers in the benefits, hazards, and proper procedures for using nitrox mixes from 22 through 40 percent oxygen content.

6.2 Qualifications of Graduates

Upon successful completion of this course:

1. Graduates may engage in diving activities utilizing EAN-22 to EAN-40 without direct supervision

Graduates would be qualified to enroll in:

1. TDI Advanced Nitrox Course
2. TDI Decompression Procedures Course
3. TDI Semi-closed Rebreather Course

6.3 Who May Teach

Any active TDI Nitrox Instructor

6.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. Since entry level nitrox is essentially an informational and academic based course, no dives are specifically required as there are no skills to evaluate.
2. Optional dives are desirable to effectively demonstrate the advantages of EAN use in practical field use. If scheduled, no direct instructor supervision is required but dives should not be conducted in environments that may exceed the existing skill or depth levels of the student.

6.5 Student Prerequisites

1. Minimum age 18, 15 with parental consent
2. Have a minimum certification of open water diver or a current enrollment in an open water diver course

6.6 Course Structure and Duration

Open Water Execution

1. Two nitrox dives are recommended but are not required

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The suggested number of classroom hours is 3

6.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

6.8 Training Material

Required material

1. *TDI Understanding Nitrox Diver* Manual

Optional Material

1. TDI plastic EAD table
2. *TDI Understanding Nitrox* PowerPoint

6.9 Required Equipment

1. Nitrox cylinder for analyzing
2. Nitrox analyzer

6.10 Required Subject Areas

The *TDI Understanding Nitrox* Manual is mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. History of Enriched Air Nitrox (EAN)
2. Physiology
    a. Oxygen
    b. Nitrogen
3. Physics
    a. Pressure review
    b. Partial pressures
4. Equipment Considerations
    a. Forty percent oxygen content and less
    b. Above 40 percent oxygen content
5. Dive Tables
    a. Equivalent air depth (EAD) introduction of concept only for demonstration
    b. EAN tables
    c. Switching mixes on repetitive dives
6. Dive Computers
    a. Mix adjustable
    b. Oxygen (O_2) integrated
7. Advantages and Disadvantages of EAN
    a. Use as air for physiological advantage with air tables or computers
    b. Use to extend no-decompression bottom times or shorten surface intervals
    c. Oxygen toxicity hazards and depth limits
    d. Discussion of myths and facts regarding EAN mixtures
8. Procedures
    a. Use and theory of oxygen analyzer
    b. Gas analysis and logging
9. Common Mixing Procedures
    a. Partial pressure blending
    b. Continuous blending
    c. Membrane separation system

6.11 Required Skill Performance and Graduation Requirements

Pre-dive

1. Use TDI Tables to plan a nitrox dive taking advantage of EAD calculations
2. Create a simple written dive plan for a nitrox dive to an maximum operating depth (MOD) calculated with PO_2 between 1.3 and 1.6 depending on environmental conditions
3. Demonstrate correct use of oxygen analyzer
4. Demonstrate correct cylinder management and labeling
5. Conduct simple pre-dive briefing (may be simulated if dives are not part of program)
6. Program nitrox computer, if used, with appropriate oxygen percentage

In order to complete this course, students must:

1. Satisfactorily complete the TDI Nitrox Course written examination
2. Demonstrate understanding of oxygen analysis for nitrox mixtures

7. Advanced Nitrox Diver

7.1 Introduction

This course examines the use of EAN-21 through 100 percent oxygen for optimal mixes to a depth of 40 metres / 130 feet. The objective of this course is to train divers in the benefits, hazards and proper procedures for utilizing EAN-21 through 100 percent oxygen for dives not requiring staged decompression. TDI Decompression Procedures or the Intro to Tech may be combined with this course at the discretion of the instructor.

7.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in diving activities utilizing EAN-21 through 100 percent oxygen without direct supervision provided:

1. The diving activities approximate those of training
2. The areas of activities approximate those of training
3. Environmental conditions approximate those of training

Upon successful completion of this course, graduates are qualified to enroll in:

1. TDI Decompression Procedures Course
2. TDI Extended Range Course

7.3 Who May Teach

Any active TDI Advanced Nitrox Instructor

7.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 8 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

7.5 Student Prerequisites

1. Minimum age 18, 15 with parental consent
2. Minimum certification of TDI Nitrox Diver, or equivalent
3. Show proof of 25 logged open water dives

4. If this course is taught in conjunction with the TDI Decompression Procedures course, the minimum age is 18

7.6 Course Structure and Duration

Open Water Execution

1. Four dives are required with a minimum accumulated bottom time of 100 minutes
2. If advanced nitrox is taught in conjunction with decompression procedures*, only a total of 6 dives are required, more may be conducted at the discretion of the instructor, with a maximum depth of 45 metres / 150 feet
3. If Advanced Nitrox is taught in conjunction with Intro to Tech*, only a total of four (4) dives are required, more may be conducted at the discretion of the instructor, but all dives must be conducted at depths within the diver's current level of certification and no dives should exceed 23 metres / 75 feet
4. Only 2 dives from advanced wreck course may be credited towards the total dives required

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 6

*A 3-way combination of TDI Intro to Tech, Advanced Nitrox and Decompression Procedures is permitted with a minimum of 8 dives required. The prerequisites for advanced nitrox and decompression procedures diver must be met for this combination before starting the program.

7.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

7.8 Training Material

Required material

1. *TDI Advanced Nitrox* Student Manual

Optional Material

1. TDI EAD I PO_2 Tables
2. *TDI Advanced Nitrox* PowerPoint Presentation
3. TDI Advanced Nitrox Cue Cards
4. *TDI Advanced Nitrox Evaluation Slate*

7.9 Required Equipment

The following equipment is required for each student:

1. Alternative second stage octopus attached to a primary regulator or a redundant scuba unit; 1.9 litre / 13 cu ft minimum
2. A submersible pressure gauge
3. Depth gauge and automatic bottom timer and/or dive computer
4. Buoyancy compensator device (BCD) with power inflator
5. Line cutting device
6. Exposure suit adequate for the open water environment
7. Cylinder and regulator properly labeled and cleaned as required for EAN mixtures
8. Access to oxygen analyzer, may be supplied by instructor

7.10 Required Subject Areas

The *TDI Advanced Nitrox* Manual is mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. Physics
    a. Pressure review
2. Physiology
    a. Hypoxia
    b. Oxygen toxicity
        i. Whole body oxygen toxicity units (OTU's)
        ii. Central nervous system (CNS)
    c. Nitrogen narcosis
    d. Nitrogen absorption and elimination
    e. Carbon dioxide toxicity
    f. Carbon monoxide toxicity
3. Formula Work
    a. Best mix computations
    b. Maximum operating depth (MOD) of mixture computations
4. Equipment Considerations
    a. Less than 40 percent oxygen content
    b. More than 40 percent oxygen content

5. Dive Tables
    a. Equivalent air depth with any table
    b. Computer generated tables
6. Dive Computers
    a. Mix adjustable
    b. Oxygen (O_2)integrated
7. Dive Planning
    a. Operation planning
        i. Gas requirements
        ii. Oxygen limitations
        iii. Nitrogen limitations
8. Common Mixing Procedures (instructor to demonstrate one method)
    a. Partial pressure blending
    b. Continuous blending
    c. Membrane separation system
9. Decompression
    a. Enriched air nitrox (EAN) usage as a decompression gas i.e. 50/50, 80/20 etc
    b. Oxygen (O_2) for decompression
    c. Advantages / disadvantages of multiple gas switches

7.11 Required Skill Performance and Graduation Requirements

Maximum training depths shall not exceed 40 metres / 130 feet. The following open water skills must be completed by the student during all open water dives:

Land Drills

1. Review of nitrox skills
2. Demonstrate correct use of oxygen analyzer including optimal procedure for calibration
3. Demonstrate adequate pre-dive planning
    a. Limits based on personal gas consumption.
    b. Limits based on oxygen exposures at planned depth with actual mix
    c. Limits based on nitrogen absorption at planned depth with actual mix
4. Calculate and log CNS loading for each dive including cumulative exposure where appropriate
5. Demonstrate understanding of gas labeling
6. Demonstrate adherence to conventions regarding prep of equipment for oxygen (O_2) service
7. Program nitrox computer with appropriate oxygen percentage if used
8. Properly execute the planned dive within all predetermined limits

In order to complete this course, students must:

1. Satisfactorily complete the TDI Advanced Nitrox course written examination
2. Complete all open water requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution

Pre-dive Drills

1. Use START* before every dive
2. Stress analysis and mitigation

***START is S-drill (OOA drill and Bubble Check), Team (buddy equipment checks), Air (gas matching), Route (entry/exit and planned path underwater), Tables (depth, duration, waypoints and schedule).**

In-water Drills

1. Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet
2. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices
3. Demonstrate ability to manage free flow from primary regulator in controlled fashion, shutdown cycle, and switch to back-up regulator
4. Conduct appropriate safety stop while maintaining neutral buoyancy
5. Demonstrate ability to share air with buddy as both recipient and donor in a controlled manner while maintaining position in water column
6. Demonstrate correct body position; appropriate trim, such as horizontal / streamlined when moving forward
7. Demonstrate proper stress analysis with self and dive buddy

8. Decompression Procedures Diver

8.1 Introduction

This course examines the theory, methods and procedures of planned stage decompression diving. This program is designed as a stand-alone course or it may be taught in conjunction with TDI Advanced Nitrox, Advanced Wreck, or Extended Range Course. The objective of this course is to train divers how to plan and conduct a standard staged decompression dive not exceeding a maximum depth of 45 metres / 150 feet unless taught in conjunction with the TDI Extended Range Course. The most common equipment requirements, equipment set-up and decompression techniques are presented. Students are permitted to utilize enriched air nitrox (EAN) mixes or oxygen for decompression provided the gas mix is within their current certification level.

8.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in decompression diving activities without direct supervision provided:

1. The diving activities approximate those of training
2. The areas of activities approximate those of training
3. Environmental conditions approximate those of training

Upon successful completion of this course, graduates are qualified to enroll in:

4. TDI Advanced Nitrox Course
5. TDI Extended Range Course
6. TDI Advanced Wreck Course
7. TDI Entry Level Trimix Course

8.3 Who May Teach

Any active TDI Decompression Procedures Instructor may teach this course

8.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

8.5 Student Prerequisites

1. Minimum age 18
2. Minimum certification of SDI Advanced Adventure Diver , Advanced Diver, or equivalent
3. Provide proof of 25 logged open water dives

8.6 Course Structure and Duration

Open Water Execution

1. Four dives are required, 2 of those dives must be deeper than 30 metres / 100 feet
2. If advanced nitrox is taught in conjunction with decompression procedures only a total of 6 dives are required
3. Only 2 dives from advanced wreck course may be credited towards the total dives required

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 6

8.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

8.8 Training Material

Required material

1. *TDI Decompression Procedures* Student Manual

Optional Material

1. *TDI Decompression Procedures* PowerPoint Presentation
2. *TDI Deco Procedures Cue Cards*
3. *TDI Deco Procedures Evaluation Slate*

8.9 Required Equipment

The following equipment is required for each student:

1. Primary cylinder(s), cylinder volume appropriate for planned dive and student gas consumption

Note: Independent and isolated back-mounted doubles, are allowed to be used.

2. Decompression mix cylinder(s)
    a. Cylinder volume appropriate for the planned dive and student gas consumption with submersible pressure gauge
    b. Labeled in accordance with TDI Standards
3. Depth gauge and automatic bottom timer and / or dive computer
4. Regulator(s)
    a. Primary and alternate 2nd stage required on all primary cylinders
    b. Submersible pressure gauges are required on all primary cylinders
5. Buoyancy compensator device(s) (BCD) adequate for equipment configuration
6. Line cutting device
7. Jon-line and other rigging lines as dictated by site conditions
8. Ascent reel with lift bag /surface marker buoy
    a. Adequate for maximum planned depth
    b. Minimum of 12 kg / 25 lb lift bag
9. Oxygen (O_2) analyzer; may be supplied by the instructor
10. Exposure suit adequate for the open water environment
11. Underwater slate

8.10 Required Subject Areas

The *TDI Decompression Procedures* Manual is mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. Overview of Decompression Safety Stops Compared to Required Stops
2. Physics
    a. Pressure review
3. Physiology
    a. Mechanics of bubble formation
    b. Advantages of hyperoxic mixes for decompression
    c. Nitrogen absorption and elimination
    d. Carbon dioxide toxicity
    e. Ascent / Descent rates
    f. Hyperthermia
    g. Hypothermia
    h. Psychological aspects
        i. Task loading

ii. Stress
iii. Panic
iv. Time management
v. Equipment

4. Decompression Options
    a. Air
    b. Nitrox
    c. Oxygen
5. Equipment Considerations
    a. Twin cylinder or single cylinder option, valve options
    b. Stage cylinder options
    c. Regulator options
    d. Harness / BCD options
    e. Computer, depth gauge, bottom timer options
    f. Ascent and navigation reels
    g. Lift bags/surface marker buoys for drifting or free decompression
    h. Jon-line or Garvin clips
    i. Proper weighting and buoyancy control during dive phase and decompression
6. Dive Tables vs. Computers
    a. Introduction and review of different models (Bühlmann, DCIEM, US Navy, etc)
    b. Proper use of electronic multi-level dive computers for dive planning and decompression
        i. Mix adjustable
        ii. Oxygen (O_2) integrated
7. Dive Planning
    a. Standard operation
        i. Gas requirements
        ii. Oxygen limitations
        iii. Nitrogen limitations
    b. Emergency planning
        i. Omitted decompression
        ii. Decompression sickness
        iii. Equipment failure
8. Procedures
    a. Primary and decompression gas
        i. Normal operations
        ii. Failure, loss or inadequate emergency procedures
        iii. Analysis and logging
        iv. Safeguards on decompression supply regulators
        v. Rigging and deployment of decompression equipment
    b. Descent

i. Methods of entry, down lines or free decent
ii. Organization of equipment carried on diver

c. Ascent
   i. Variable rates
   ii. Trim and compensation
d. Fixed or Drifting Decompression Methods
   i. Up-lines fixed to bottom
   ii. Reels and lift bags/surface marker buoys
   iii. Free drifting stages or boat supplied
   iv. Self-contained versus surface supply / rendezvous gas cylinders
e. Support
   i. From shore
   ii. From descent line or fixed platform
   iii. From live-aboard boat

8.11 Required Skill Performance and Graduation Requirements

The following open water skills must be completed by the student during open water dives:

1. Skills review from previous TDI skills requirements

Land Drills

1. Selection and preparation of equipment suitable for soft overhead environment
2. Conduct team oriented drills, buddy checks, for lift bag deployment
3. Conduct team oriented drills, buddy checks, for gas switching procedures
4. Gas matching among buddy team
5. Demonstrate familiarity with basic hand signals
6. Demonstrate adequate pre-dive planning
   a. Limits based on personal and team gas consumption
   b. Exact dive and decompression profile

Pre-dive Drills

1. Use START* before every dive
2. Stress analysis and mitigation

***START is S-drill (OOA drill and Bubble Check), Team (buddy equipment checks), Air (gas matching), Route (entry/exit and planned path underwater), Tables (depth, duration, waypoints and schedule).**

In-water Drills

1. Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet
2. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices
3. Demonstrate comfort swimming on surface and at depth carrying single decompression stage cylinder

4. Demonstrate ability to drop and retrieve single decompression cylinder while maintaining position in the water column
5. Demonstrate ability to deploy a lift bag solo and as member of team
6. Demonstrate controlled / staged ascent on lift bag / emergency ascent line (lost ascent line)
7. Remove and replace mask (deploy backup mask)
8. Demonstrate appropriate reaction to gas hemorrhage from manifold or first stage, SPG and primary regulator
9. React to BCD inflator malfunction; disconnect LP hose, dump gas and orally inflate BCD/Wing to neutral buoyancy
10. Demonstrate ability to confirm gas switch(es) at depth with buddy/team members
11. Buddy breathing decompression gas for at least 1 minute
12. Switch to back-up mask, remove and replace mask
13. Demonstrate appropriate reaction to simulated free-flowing decompression regulator
14. Demonstrate appropriate modifications to deco schedule in decompression emergency (over time, over depth) (to be simulated)
15. Demonstrate tired diver tow at depth and on surface, 30 metres / 100 feet lateral each
16. Complete a horizontal breath hold swim at depth for 15 metres / 45 feet
17. Properly execute the planned dive within all pre-determined limits
    a. Assembly of diver carried equipment
    b. Proper descent / ascent rates
    c. Proper staged stop procedures
    d. Monitoring of decompression status equipment; tables, computers, equipment
18. Contingency situations and problem solving, as appropriate by instructor
    a. Omitted decompression.
    b. Extended bottom time profiles with increased decompression and recalculated schedules
    c. Failure to deploy lift bag and reel
    d. Missed up-line or missed boat anchor
    e. Loss of decompression gas
19. A safety stop of at least 3 minutes shall be conducted on all no-decompression dives and proper staged decompression stops whenever and wherever mandated.
20. Demonstrate (simulated) emergency gas sharing at a stationary depth not to exceed 30 metres / 100 feet
21. Demonstrate emergency deployment of a backup regulator or bail-out scuba system containing bottom mix at a depth not exceeding 30 metres / 100 feet
22. Demonstrate the proper deployment, management and use of the bottom mix, decompression mix and travel mix, if used, including but not limited to:
    a. Conservative gas management
    b. Depth control to avoid descending too deep for mix
    c. Show appropriate and timely responses to instruction / signals from the instructor and demonstrate buoyancy control and awareness throughout the dive

In order to complete this course, students must:

1. Satisfactorily complete the TDI Decompression Procedures Course written examination

2. Complete all open water requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution

9. Extended Range Diver

9.1 Introduction

This course provides training and experience required to competently utilize air for dives up to 55 metres / 180 feet that requires staged decompression, utilizing nitrox mixtures or oxygen during decompression. The objective of this course is to train divers in the proper techniques, equipment requirements, and hazards of deep air diving to a maximum of 55 metres / 180 feet utilizing nitrox mixtures or oxygen for staged decompression.

9.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in decompression diving activities without direct supervision provided:

1. The diving activities approximate those of training
2. The areas of activities approximate those of training
3. Environmental conditions approximate those of training

Upon successful completion of this course, graduates are qualified to enroll in:

1. TDI Advanced Wreck Course
2. TDI Entry Trimix Course
3. TDI Advanced Trimix Course

9.3 Who May Teach

This course may be taught by any active TDI Extended Range Instructor

9.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

9.5 Student Prerequisites

1. Minimum age 18
2. Certified as a TDI Advanced Nitrox Diver and TDI Decompression Procedures Diver, or equivalents
3. Provide proof of a minimum of 100 logged dives, of which 25 must be deeper than 30 metres / 100 feet

9.6 Course Structure and Duration

Open Water Execution

1. Four dives with a minimum accumulated bottom time of 100 minutes
2. All dives must be deeper than 30 metres / 100 feet with 2 dives deeper than 40 metres / 130 feet
3. A maximum of 2 dives from advanced wreck course may be credited towards the total dives required, at the instructor's discretion

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 8

9.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

9.8 Training Material

Required Material

1. *TDI Extended Range Entry Level Trimix Diver* Manual

Optional Material

1. *TDI Extended Range Entry Level Trimix* PowerPoint
2. *Deep Diving; An Advanced Guide to Physiology, Procedures and Systems,* Revised 2nd edition 1995, by Bret Gilliam
3. *TDI Extended Range Cue Cards*
4. *TDI Extended Range Evaluation Slate*

9.9 Required Equipment

The following equipment is required for each student:

1. Bottom mix cylinder(s)

   a. Cylinder volume appropriate for planned dive and student gas consumption
   b. Dual outlet valve, double manifold or independent doubles
   c. Labeled in accordance with TDI Standards
2. Travel mix cylinder(s) if used
   a. Cylinder volume appropriate for planned dive and student gas consumption
   b. Labeled in accordance with TDI Standards
3. Decompression mix cylinder(s)
   a. Cylinder volume appropriate for planned dive and student gas consumption
   b. Labeled in accordance with TDI Standards
4. Regulator(s)
   a. Primary and primary redundant regulators required on all bottom mix cylinders
   b. Submersible pressure gauges are required on all primary / bottom mix cylinder(s)
   c. A contingency use long hose second stage should be designated and appropriately rigged to facilitate air sharing at depth if necessary
5. Buoyancy compensator device(s) (BCD) adequate for equipment configuration
6. Redundant depth and timing devices
7. Air decompression computers allowed for use as depth and timing devices
8. Redundant light system if needed for site conditions
9. Jon-line and other rigging lines as dictated by site conditions
10. Ascent reel with lift bag/surface marker buoy
    a. Adequate for maximum planned depth
    b. Minimum of 12 kg / 25 lb. lift bag/surface marker buoy
11. Exposure suit adequate for the open water environment
12. Two line cutting devices
13. Underwater slate (for decompression/contingency tables)

9.10 Required Subject Areas

The *TDI Extended Range* Manual is mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. History of Deep Air Diving
2. Physics
   a. Pressure review
   b. Formulas for solving dive planning problems, maximum operating depth (MOD), best mix, etc
3. Physiology
   a. Hypoxia
   b. Oxygen toxicity
      i. Whole body (OTUs)
      ii. Central nervous system
   c. Nitrogen narcosis

   d. Nitrogen absorption and elimination
   e. Carbon dioxide toxicity (CO_2)
   f. Carbon monoxide (CO)
   g. Hyperthermia
   h. Hypothermia
4. Decompression Options
   a. Air
   b. Nitrox
   c. Oxygen
5. Equipment Considerations
   a. Twin cylinder or single cylinder option
   b. Stage cylinder options
   c. Regulator options
   d. Harness / BCD options
   e. Computer / depth gauge / bottom timer options
   f. Ascent and navigation reels
   g. Lift bags/surface marker buoys for drifting or free decompression
   h. Lights
   i. Redundant mask and knife
   j. Jon-line or Garvin clips
6. Dive Tables
   a. Introduction and review of different models (Bühlmann, DCIEM, U.S. Navy recommended)
   b. Introduction to computer generated tables
7. Dive Planning
   a. Operation planning
      i. Support
      ii. Teams
   b. Team planning
      i. Gas requirements
      ii. Oxygen limitations
      iii. Nitrogen limitations
   c. Emergency planning
      i. Omitted decompression
      ii. Oxygen toxicity
      iii. Decompression sickness
      iv. General
8. Procedures
   a. Bottom, travel and decompression gas
      i. Normal operations
      ii. Failure, loss or inadequate emergency procedures

iii. Analysis and logging

b. Descent
   i. Methods of entry, down lines or free descent
   ii. Recognizing narcosis
   iii. Breathing
   iv. Organization of equipment carried on diver

c. Ascent
   i. Variable rates
   ii. Trim and compensation

d. Support

e. Navigation
   i. From shore
   ii. From descent line
   iii. From live-a-board vessel

9.11 Required Skill Performance and Graduation Requirements

The following open water skills must be completed by the student during open water dives:

Note: The maximum depth for this course is 55 metres / 180 feet

1. Skills review from previous TDI skills requirements

Land Drills

1. Demonstrate familiarity with basic and intermediate hand signals
2. Selection and preparation of equipment suitable for soft overhead environment with long decompression obligations
3. Conduct team oriented drills for lift bag deployment and gas switching procedure
4. Drills for buddy rescue
5. Drills for toxed diver / unconscious diver ascent
6. Properly analyze all gas mixtures to be used
7. Demonstrate adequate pre-dive planning
   a. Limits based on personal and team gas consumption
   b. Limits based on oxygen exposures at planned depths for actual mixes
   c. Limits based on nitrogen absorption at planned depths for actual mixes

Pre-dive Drills

1. Use START* before every dive
2. Stress analysis and mitigation
3. Gas matching among buddy team

***START is S-drill (OOA drill and Bubble Check), Team (buddy equipment checks), Air (gas matching), Route (entry/exit and planned path underwater), Tables (depth, duration, waypoints and schedule).**

In-water Drills

1. Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet
2. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices
3. Demonstrate competence managing 2 stage cylinders, either 2 deco gas or 1 deco and extra bottom gas, including drop and recovery while maintaining position in the water column
4. Demonstrate ability to confirm gas switches at depth with buddy/team members
5. Demonstrate lift bag deployment from depth and use of bag as back-up buoyancy device
6. Demonstrate air-sharing ascent from depth while one member of buddy team is without mask, both as a donor and recipient
7. Create contingency decompression schedule after simulated loss of decompression gas
8. Remove and replace mask, deploy back up mask
9. Demonstrate tired diver tow at depth and on surface; 30 metres / 100 feet lateral
10. Complete a horizontal breath-hold swim at depth for 15 metres / 50 feet with mask off or blacked out
11. Properly execute the planned dive within all pre-determined limits
12. Demonstrate the proper procedures for switching and isolating a malfunctioning regulator. This skill is to be performed at a depth no deeper than 40 metres / 130 feet
13. Demonstrate the proper navigational techniques for the specific dive
14. During 2 dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression
15. During 1 of the dives, tow a simulated unconscious diver, while at depth, 9 metres / 30 feet to ascent line and simulate an emergency rescue ascent technique

In order to complete this course, students must:

1. Satisfactorily complete the *TDI Extended Range* Course written examination
2. Complete all open water requirements safely and efficiently
3. Demonstrate mature and sound judgment concerning dive planning and execution

10. Helitrox Diver

10.1 Introduction

The Helitrox course examines the theory, methods and procedures for planned stage decompression diving utilizing Helium in the breathing mixture. This program is designed as a stand-alone course or it may be taught in conjunction with TDI Advanced Nitrox at the discretion of the instructor. The objective of this course is to train divers how to plan and conduct a standard staged decompression dive not exceeding a maximum depth of 45 metres / 150 feet. The most common equipment requirements, gear set-up, and decompression techniques are presented. Students are permitted to utilize Enriched Air Nitrox and Helium mixes with no greater than 20% He content, and up to 100% oxygen for decompression diving provided the gas mix is within their current certification level. Breathing gas mixtures containing more than 20% Helium or less than 21% oxygen *are not permitted (+/- 1%)*.

10.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in decompression diving activities without direct supervision, utilizing helium and/or nitrox mixtures so long as:

1. The diving activities approximate those of training
2. The areas of activities approximate those of training
3. Environmental conditions approximate those of training
4. Breathing mixtures do not contain more than 20% Helium or less than 21% Oxygen *(+/- 1%)* and are within their current diving certification level

Upon successful completion of this course, graduates are qualified to enroll in:

1. TDI Extended Range Course
2. TDI Trimix

10.3 Who May Teach

Any active TDI Helitrox Instructor who has been approved by TDI Headquarters Training Department

10.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per instructor: it is the instructor's discretion to reduce this number as conditions dictate.

10.5 Student Prerequisites

1. Minimum age 18
2. Certified as an SDI Advanced Diver (with Deep specialty) or TDI Intro to Tech or equivalent
3. Certified as a TDI Advanced Nitrox Diver or equivalent. Student may be enrolled in both the TDI Helitrox and Advanced Nitrox course at the same time
4. Provide proof of 50 logged dives

10.6 Course Structure and Duration

Open Water Execution

1. 4 dives are required, 2 of those dives must be deeper than 30 metres / 100 feet
2. If Advanced Nitrox is taught in conjunction with Helitrox, a minimum of 6 dives are required

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. A minimum of 6 hours for classroom and briefing hours is required

10.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

10.8 Training Material

Required material

1. *TDI Decompression Procedures* Student Manual
2. *TDI Extended Range/Trimix* Student Manual

Optional Material

3. Corresponding TDI PowerPoint presentations
4. *TDI Advanced Trimix* Manual
5. TDI Helitrox Cue Cards
6. TDI Helitrox Evaluation Slate

10.9 Required Equipment

The following equipment is required for each student:

1. Primary cylinder(s); cylinder volume appropriate for planned dive and student gas consumption
2. Decompression mix cylinder(s)
3. Cylinder volume appropriate for the planned dive and student gas consumption with submersible pressure gauge
4. Labeled in accordance with TDI Standards.
5. Depth gauge and automatic bottom timer **and** *I* **or** dive computer programmable with appropriate breathing mixture(s)
6. Regulator(s)
7. Primary and alternate 2nd stage required on all primary cylinders
8. Submersible pressure gauges are required on all primary cylinders
9. Buoyancy compensator device(s) (BCD(appropriate for equipment configuration
10. Line cutting device
11. Jon-line and other rigging lines as dictated by site conditions
12. Ascent reel with lift bag /surface marker buoy
13. Appropriate for maximum planned depth
14. Minimum of 12kg / 25lb lift bag
15. Oxygen analyzer and helium analyzer; may be supplied by the instructor
16. Exposure suit adequate for the open water environment
17. Underwater slate

10.10 Required Subject Areas

The TDI *Decompression Procedures and Extended Range/Trimix* Manuals are mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. Overview of decompression "safety stops" compared to required stops
2. Physics
    a. Pressure review
3. Physiology
    a. Mechanics of bubble formation
    b. Advantages of hyperoxic mixes for decompression

c. Advantages of helium mixes for bottom gas
d. Hypoxia
e. Oxygen toxicity
    i. Whole Body (OTUs)
    ii. Central Nervous System (CNS)
f. Nitrogen Narcosis
g. Nitrogen and Helium Absorption and Elimination
h. Carbon Dioxide Toxicity
i. Carbon Monoxide Toxicity
j. Helium
    i. HPNS
    ii. Effects on respiration
    iii. Effects as an insulator
k. Counter Diffusion
l. Hyperthermia
m. Hypothermia
n. Ascent / Descent rates
o. Psychological aspects
    i. Task loading
    ii. Stress
    iii. Panic
    iv. Time Management
    v. Equipment

4. Decompression Options
    a. Air
    b. Nitrox
    c. Oxygen
5. Equipment Considerations
    a. Twin cylinder or single cylinder option, valve options
    b. Stage cylinder options
    c. Regulator Options
    d. Harness / BCD options
    e. Computer, depth gauge, bottom timer options
    f. Ascent and navigation reels
    g. Lift bags/surface marker buoys for drifting or free decompression
    h. Jon-line or Garvin clips
    i. Proper weighting and buoyancy control during dive phase and decompression
6. Dive Tables vs. Computers
    a. Introduction and review of different models (Bühlmann, DCIEM, US Navy, etc)
    b. Proper use of electronic multi-level dive computers for dive planning and decompression

i. Mix adjustable
ii. 0_2 integrated

7. Dive Planning
    a. Standard Operation
        i. Gas requirements
        ii. Oxygen limitations
        iii. Nitrogen limitations
        iv. Helium limitations
    b. Emergency planning
        i. Omitted decompression
        ii. Decompression sickness
        iii. Equipment failure
8. Procedures
    a. Primary and Decompression Gas
        i. Normal operations
        ii. Failure, loss or inadequate emergency procedures
        iii. Analysis and logging
        iv. Safeguards on decompression supply regulators
        v. Rigging and deployment of decompression equipment
    b. Descent
        i. Methods of entry, down lines or free decent
        ii. Organization of equipment carried on diver
    c. Ascent
        i. Variable rates
        ii. Trim and compensation
    d. Fixed or Drifting Decompression Methods
        i. Up-lines fixed to bottom
        ii. Reels and lift bags/surface marker buoys
        iii. Free drifting stages or boat supplied
        iv. Self-contained versus surface supply / rendezvous gas cylinders
    e. Support
        i. From shore
        ii. From descent line or fixed platform
        iii. From live-aboard boat

10.11 Required Skill Performance and Graduation Requirements

The following open water skills must be completed by the student during open water dives:

1. Skills review from previous TDI skills requirements

Land Drills:

1. Selection and preparation of equipment suitable for soft overhead environment
2. Conduct team oriented drills (buddy checks) for lift bag deployment
3. Conduct team oriented drills (buddy checks) for gas switching procedures
4. Gas matching among buddy team
5. Demonstrate familiarity with basic hand signals
6. Demonstrate adequate pre-dive planning
    a. Limits based on personal and team gas consumption.
    b. Exact dive and decompression profile.

Pre-dive Drills:

1. Use START* before every dive
2. Stress analysis and mitigation

In-water Drills:

1. Demonstrate buoyancy control (ability to hover at fixed position in water column without moving hands or feet)
2. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices
3. Demonstrate comfort swimming on surface and at depth carrying single decompression stage bottle
4. Demonstrate ability to drop and retrieve single decompression cylinder while maintaining position in the water column
5. Demonstrate ability to deploy a lift bag solo and as member of team
6. Demonstrate controlled / staged ascent on lift bag / emergency ascent line (lost ascent line)
7. Remove and replace mask (deploy backup mask)
8. Demonstrate appropriate reaction to gas hemorrhage from manifold or first stage, SPG and primary regulator
9. React to BCD inflator malfunction (disconnect LP hose, dump gas and orally inflate BCD/Wing to neutral buoyancy)
10. Demonstrate ability to confirm gas switch(es) at depth with buddy/team members
11. Buddy breathing deco gas for at least one minute
12. Switch to back-up mask (remove and replace mask)
13. Demonstrate appropriate reaction to simulated free-flowing deco regulator
14. Demonstrate appropriate modifications to deco schedule in decompression emergency (over time, over depth) (to be simulated)
15. Demonstrate tired diver tow at depth and on surface (30 meters / 90 feet lateral each)
16. Complete a horizontal breath hold swim at depth for 15 meters / 45 feet
17. Properly execute the planned dive within all pre-determined limits
    a. Assembly of diver carried equipment
    b. Proper descent / ascent rates
    c. Proper staged stop procedures
    d. Monitoring of decompression status equipment (tables, computers, equipment)

18. Contingency Situations and Problem Solving (as appropriate by instructor)
    a. Omitted decompression
    b. Extended bottom time profiles with increased decompression and re-calculated schedules
    c. Failure to deploy lift bag and reel
    d. Missed up-line or missed boat anchor
    e. Loss of decompression gas
19. A safety stop of at least 3 minutes shall be conducted on all no-decompression dives and proper staged decompression stops whenever and wherever mandated.
20. Demonstrate (simulated) emergency gas sharing at a stationary depth not to exceed 30 metres / 100 feet
21. Demonstrate emergency deployment of a backup regulator or bail-out scuba system containing bottom mix at a depth not to exceed 30 metres / 100 feet
22. Demonstrate the proper deployment, management and use of the bottom mix, decompression mix and travel mix (if used), including but not limited to:
    a. Conservative gas management
    b. Depth control to avoid descending too deep for mix
    c. Show appropriate and timely responses to instruction / signals from the instructor and demonstrate buoyancy control and awareness throughout the dive

In order to complete this course, students must:

1. Satisfactorily complete the TDI Decompression Procedures Course written examination
2. Complete all open water requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution

11. Advanced Wreck Diver

11.1 Introduction

This course provides training and experience to competently conduct advanced wreck dives. This program includes penetration skills and techniques. Depths shall not exceed the level in which the diver is trained and competent, but in no case shall the maximum depth in this program exceed 55 metres / 180 feet. The objective of this course is to train divers in the proper techniques, equipment requirements and hazards of wreck diving.

11.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in wreck diving activities without direct supervision provided:

1. The diving activities approximate those of training
2. The areas of activities approximate those of training
3. Environmental conditions approximate those of training

11.3 Who May Teach

Any active TDI Advanced Wreck Diving Instructor may teach this course

11.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

11.5 Student Prerequisites

1. Minimum age 18
2. Certified as an SDI Advanced Open Water Diver or equivalent
3. Provide proof of a minimum of 50 logged dives
4. Be certified as TDI Basic Wreck or Cavern Diver or equivalent

11.6 Course Structure and Duration

Open Water Execution

1. Six penetration / overhead dives and an accumulated bottom time of 100 minutes.
2. Only 2 dives from the TDI Advanced Wreck course may be credited towards the total dives required for TDI Advanced Nitrox, Decompression Procedures, Extended Range or Entry Level Trimix

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 8

11.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* form
    b. *TDI Medical Statement* form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration form to TDI Headquarters or registering the students online through member's area of the TDI website

11.8 Training Material

Required material

1. *TDI Advanced Wreck Diving* Diver Manual

Optional Material

1. TDI Advanced Wreck Cue Cards
2. TDI Advanced Wreck Evaluation Slate

11.9 Required Equipment

The following equipment is required for each student

1. Primary cylinder(s)
    a. Cylinder volume appropriate for the planned dive and student gas consumption rate
    b. Dual valve, double manifold or independent doubles
    c. Labeled in accordance with TDI Standards
2. Travel or decompression cylinders as required by site conditions

3. Regulators
    a. Primary and primary redundant required on all primary breathing cylinders
    b. Submersible pressure gauges are required on all primary cylinder(s)
    c. A contingency use long hose second stage should be designated and appropriately rigged to facilitate air sharing at depth if necessary
4. Buoyancy compensator device(s) (BCD) adequate for the open water environment
5. Back-up depth and timing devices
6. Air decompression computers allowed for use as depth and timing devices
7. Light Systems
    a. Primary
    b. Back-up
8. Ascent reel with lift bag/surface marker buoy or up-line
    a. Adequate for the planned maximum depth
    b. Minimum of 12 kg / 25lb lift
9. Exposure suit adequate for the open water environment
10. Two line cutting devices
11. Underwater slate
12. Reels
    a. Primary penetration reel
    b. Safety reel
13. Options that the instructor may require
    a. Submersible dive tables
    b. Bail-out cylinder with regulator
    c. Jon-line
    d. Slate, compass, surface signaling device (flare, strobe, etc.)

11.10 Required Subject Areas

The following land drills must be covered during this course

1. Guideline Use
2. Guideline Following
3. Emergency Procedures

The following topic must be covered during this course. Instructors may use any text or materials that they feel best presents these topics.

1. Equipment Considerations
    a. Redundant scuba
    b. Lights
    c. Reels
    d. Tools
2. Procedures

   a. Pre-dive
   b. Pre-penetration
   c. Penetration
   d. Exiting the wreck
3. Hazards of Wreck Diving and Overhead Environments
   a. Disorientation
   b. Reduced visibility
   c. Entrapment
   d. Entanglement
   e. Environmental.
   f. Loss of gas supply
   g. Line traps
   h. Separated buddy teams
4. Penetration Lines
   a. Types
   b. Proper use
5. Research and Locating
   a. Local regulations
   b. Sources of information
   c. Tools.
   d. Surveying
6. Contingency Planning
   a. Chamber locations
   b. Communications
   c. Emergency gases

11.11 Required Skill Performance and Graduation Requirements

The student must complete the following skills during wreck dives. All dives should be conducted with a maximum depth no deeper than the certified student's capabilities.

Land Drills

1. Proper deployment of guideline
2. Proper technique for following guideline
3. Use safety spool / reel in lost line procedures
4. Use safety spool / reel in lost buddy procedures
5. Proper technique for touch contact communication
6. Properly analyze all gas mixtures to be used
7. Demonstrate adequate pre-dive planning
   a. Limits based on personal and team gas consumption
   b. Limits based on oxygen exposures at planned depths for actual mixes

c. Limits based on nitrogen absorption at planned depths for actual mixes

Pre-dive Drills

1. Use START* before every dive
2. Stress analysis and mitigation

***START is S-drill (OOA drill and Bubble Check), Team (buddy equipment checks), Air (gas matching), Route (entry/exit and planned path underwater), Tables (depth, duration, waypoints and schedule).**

In-water Drills

1. Demonstrate specialized propulsion techniques for an overhead environment
2. Deploy guideline with attention to immediate environment and conditions
3. Demonstrate lost line and lost buddy drills
4. Follow guideline, eyes open and eyes closed, or blacked out mask
5. Air share with team member(s) while exiting confined space, eyes open and eyes closed, or blacked out mask
6. Remove and replace mask while in contact with guideline
7. Demonstrate light and hand communications with team members
8. Demonstrate touch contact with team members
9. Simulate primary light failure and deployment of backup lights
10. Demonstrate correct techniques for staging deco/contingency gas outside wreck
11. Demonstrate proper procedure for isolating and switching a malfunctioning regulator; this drill should be conducted no deeper than 30 metres / 100 feet
12. Demonstrate ability to deploy a lift bag from depth as emergency ascent line
13. Demonstrate ability to deploy a lift bag from depth as alternative buoyancy device
14. Execute simulated emergency blue water ascent with marker deployment from staged stop below 6 metres / 20 feet; simulated or actual boating
15. Demonstrate understanding of basic wreck layout and special considerations for navigating wreck
16. Deal with diver presenting signs of serious decompression sickness (DCS) at surface; simulated emergency evacuation
17. Properly execute the planned dive within all pre-determined limits
18. Demonstrate the proper navigational techniques for the specific dive
19. Demonstrate out of air sharing with long hose through a restriction
20. Deployment of lift bag or up line for decompression
21. Silt-out procedures
22. Follow line while sharing air
23. Follow line with eyes closed while air sharing

In order to complete this course, students must:

1. Complete all field exercise and open water requirements safely and efficiently
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Satisfactorily complete the *TDI Advanced Wreck* Course written examination

12. Trimix Diver

12.1 Introduction

The TDI Trimix course provides the training required to competently and safely utilize breathing gases containing helium for dives that require staged decompression, utilizing nitrox and / or oxygen mixtures during decompression to a maximum depth of 60 metres / 200 feet. The objective of this course is to train divers in the benefits, hazards and proper procedures of utilizing custom oxygen / helium / nitrogen mixtures as breathing gases. Gas mixes are not to have any less than 18 percent oxygen (O_2).

12.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in technical diving activities utilizing custom trimix mixtures without direct supervision provided:

1. The diving activities approximate those of training
2. The areas of activities approximate those of training
3. Environmental conditions approximate those of training
4. Oxygen (O_2) percentages are 18 percent or higher

12.3 Who May Teach

Any active TDI Trimix Instructor may teach this course

12.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

12.5 Student Prerequisites

1. Minimum age 18
2. Minimum certification as a TDI Advanced Nitrox Diver and TDI Decompression Procedures Diver, or equivalent
3. Provide proof of a minimum 100 logged dives

12.6 Course Structure and Duration

Open Water Execution:

1. Four decompression dives are required with a minimum accumulated bottom time of 100 minutes
2. Two of the dives should be deeper than 40 metres / 130 feet

Course Structure:

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration:

1. The minimum number of classroom and briefing hours is 8

12.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of a TDI course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

12.8 Training Material

Required material

1. *TDI Extended Range Entry Level Trimix* Diver Manual

Optional Material

1. *TDI Extended Range Entry Level Trimix* PowerPoint
2. *TDI Trimix* Cue Cards
3. *TDI Trimix* Evaluation Slate

12.9 Required Equipment

The following equipment is required for each student:

1. Bottom mix cylinder(s)
    a. Cylinder volume appropriate to complete all planned decompression on bottom mix
    b. Dual outlet valve, double manifold or independent doubles
    c. Labeled in accordance with TDI Standards

2. Decompression mix cylinder(s)
    a. Cylinder volume should contain a minimum of 1.5 times the gas required for the planned decompression
    b. Labeled in accordance with TDI Standards
3. Suit inflation cylinder, required for dry suit divers only
4. Regulators
    a. Primary and primary redundant required on all bottom mix cylinder(s)
    b. Submersible pressure gauges are required on all primary / bottom mix cylinders
    c. A contingency use long hose second stage should be designated and appropriately rigged to facilitate air sharing at depth if necessary
    d. It is strongly recommended that the 3 required regulators be all DIN or all yoke
5. Buoyancy compensator device(s) (BCD) adequate for equipment configuration
6. Redundant depth and timing devices
7. Air decompression computers are allowed for use as depth and timing devices, provided they have a gauge mode
8. Redundant light system if required by site
9. Ascent reel with lift bag/surface marker buoy
    a. Adequate for maximum planned depth
    b. Minimum of 23 kg / 50 lb lift bag; a dump valve highly recommended
10. Exposure suit adequate for the open water environment
11. Line cutting device
12. Underwater slate, (for decompression / contingency tables
13. Helium analyzer, recommended

12.10 Required Subject Areas

The *TDI Extended Range Entry Level Trimix* Manual is mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. Physics
    a. Pressure review
2. Physiology
    a. Hypoxia
    b. Oxygen (O_2) toxicity
        i. Whole Body (OTU's)
        ii. Central nervous system (CNS)
    c. Nitrogen narcosis
    d. Nitrogen and helium absorption and elimination
    e. Carbon dioxide (CO_2) toxicity
    f. Carbon monoxide (CO) toxicity
    g. Helium

        i. HPNS
        ii. Effects on respiration
        iii. Effects as an insulator
    h. Counter diffusion
    i. Hyperthermia
    j. Hypothermia
3. Decompression Options
    a. Air
    b. Nitrox
    c. Helium
4. Equipment Considerations
    a. Cylinder options
    b. Stage cylinders options
    c. Suit inflation options
    d. Regulator options
    e. Harness / BCD options
    f. Computer / depth gauge / bottom timer options
    g. Ascent and navigation reels
    h. Lift bags/surface marker buoys
    i. Lights
    j. Redundant mask and knife
    k. Jon-line
5. Dive Tables
    a. Computer generated tables
    b. DCIEM Heliox Tables or other published tables
6. Dive Planning
    a. Operational planning
        i. Support
        ii. Teams
    b. Team planning
        i. Gas requirements
        ii. Oxygen limitations
        iii. Inert gas limitations
    c. Emergency planning
        i. Omitted decompression
        ii. Oxygen toxicity
        iii. Analysis and logging
        iv. General
7. Procedures
    a. Bottom, travel and decompression gas

i. Normal operations
ii. Failure, loss or inadequate emergency procedures
iii. Analysis and logging

12.11 Required Skill Performance and Graduation Requirements

The following open water skills must be completed by the student during open-water dives. It is recommended that all dives be conducted between 30 metres / 100 feet and 60 metres / 200 feet. Gas mixes are not to have any less than 18 percent oxygen (O_2).

1. Skills review from previous TDI skills requirements

Land Drills

1. Demonstrate familiarity with basic and intermediate hand signals
2. Select and prepare equipment suitable for soft overhead environment with long decompression obligations
3. Conduct team oriented drills for lift bag deployment and gas switching procedure
4. Drills for buddy rescue
5. Properly analyze all gas mixtures to be used
6. Demonstrate adequate pre-dive planning
    a. Limits based on personal and team gas consumption
    b. Limits based on oxygen exposures at planned depths for actual mixes
    c. Limits based on inert gas absorption at planned depths with actual mixes

Pre-dive Drills

1. Use START* before every dive
2. Stress analysis and mitigation

***START is S-drill (OOA drill and Bubble Check), Team (buddy equipment checks), Air (gas matching), Route (entry/exit and planned path underwater), Tables (depth, duration, waypoints and schedule).**

In-water Drills

1. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices
2. Demonstrate competence managing 2 stage cylinders, either 2 deco gas or 1 deco and 1 extra bottom gas, including drop and recovery while maintaining position in the water column
3. Demonstrate ability to confirm gas switches at depth with buddy/team members
4. Demonstrate lift bag deployment from depth and use of bag as back-up buoyancy device
5. Demonstrate air-sharing ascent from depth while one member of buddy team is without mask
6. Create contingency decompression schedule after simulated loss of decompression gas
7. Demonstrate controlled ascent with toxed diver including surface tow at least 30 metres / 100 feet with equipment removal on surface, in water too deep to stand in
8. Complete a horizontal breath-hold swim at depth for 15 metres / 50 feet with mask off or blacked out
9. Properly execute the planned dive within all predetermined limits
10. Demonstrate the proper navigational techniques for the specific dive
11. On 2 of the dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression

12. Demonstrate the proper procedures for switching and isolating a malfunctioning primary regulator This exercise should not be practiced deeper than 40 metres / 130 feet
13. Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet

In order to complete this course, students must:

1. Satisfactorily complete the TDI Trimix Course written examination
2. Complete all open water requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution

13. Advanced Trimix Diver

13.1 Introduction

The TDI Advanced Trimix course provides the training required to competently and safely utilize breathing gases containing helium for dives that require staged decompression, utilizing nitrox and / or oxygen (O_2) mixtures during decompression to a maximum depth of 100 metres / 330 feet. The objective of this course is to train divers in the benefits, hazards and proper procedures of utilizing custom oxygen / helium / nitrogen mixtures as breathing gases.

13.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in technical diving activities utilizing custom trimix mixtures without direct supervision provided:

1. The diving activities approximate those of training
2. The area of activities approximates those of training
3. Environmental conditions approximate those of training

13.3 Who May Teach

Any active TDI Advanced Trimix Instructor may teach this course

13.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

13.5 Student Prerequisites

1. Minimum age 18
2. Minimum certification TDI Extended Range Diver or Entry Level Trimix Diver, or equivalent
3. Provide proof of a minimum 100 logged dives with 25 deeper than 30 metres / 100 feet
4. Provide proof of prior logged experience w/ double cylinders and any other unfamiliar equipment such as dry suit

13.6 Course Structure and Duration

Open Water Execution

1. Four dives with a minimum accumulated bottom time of 100 minutes
2. At least 2 dives should be deeper than 70 metres / 230 feet

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 8

13.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

13.8 Training Material

Required material

1. *TDI Advanced Trimix* Diver Manual

Optional Material

1. *TDI Advanced Trimix* PowerPoint Presentation
2. TDI Advanced Trimix Cue Cards
3. TDI Advanced Trimix Evaluation Slate

13.9 Required Equipment

The following equipment is required for each student:

1. Bottom mix cylinder(s)
    a. Cylinder volume appropriate for planned dive and student gas consumption
    b. Dual outlet valve, double manifold or independent doubles
    c. Labeled in accordance with TDI Standards

2. Travel mix cylinder(s)
    a. Cylinder volume appropriate for planned dive and student gas consumption
    b. Labeled in accordance with TDI Standards
3. Decompression mix cylinder(s)
    a. Cylinder volume appropriate for planned dive and student gas consumption
    b. Labeled in accordance with TDI Standards
4. Suit inflation cylinder, required for dry suit divers only
5. Regulators
    a. Primary and primary redundant required on all bottom mix cylinder(s)
    b. Submersible pressure gauges are required on all primary bottom mix cylinders
    c. A contingency use long hose second stage should be designated and appropriately rigged to facilitate air sharing at depth if necessary
    d. It is strongly recommended that all 4 required regulators be all DIN or all 4 yoke
6. Buoyancy compensator device(s) (BCD) adequate for equipment configuration
7. Redundant depth and timing devices; air decompression computers allowed for use as depth and timing devices
8. Redundant light system if required by site
9. Ascent reel with lift bag/surface marker buoy
    a. Adequate for maximum planned depth
    b. Minimum of 23 kg / 50 lb lift bag; a dump valve highly recommended
10. Exposure suit adequate for the open water environment
11. Line cutting device
12. Underwater slate, for decompression / contingency tables
13. Helium analyzer, recommended

13.10 Required Subject Areas

The *TDI Advanced Trimix* Manual is mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. Physics
    a. Pressure review
2. Physiology
    a. Hypoxia
    b. Oxygen (O_2) toxicity
        i. Whole Body (OTUs)
        ii. Central nervous system (CNS)
    c. Nitrogen narcosis
    d. Nitrogen and helium absorption and elimination
    e. Carbon dioxide (CO_2) toxicity
    f. Carbon monoxide (CO) toxicity

   g. Helium
      i. HPNS
      ii. Effects on respiration
      iii. Effects as an insulator
   h. Counter diffusion
   i. Hyperthermia
   j. Hypothermia
3. Decompression Options
   a. Air
   b. Nitrox
   c. Helium
4. Equipment Considerations
   a. Cylinder options
   b. Stage cylinders options
   c. Suit inflation options
   d. Regulator options
   e. Harness / BCD options
   f. Computer / depth gauge bottom timer options
   g. Ascent and navigation reels
   h. Lift bags/surface marker buoys
   i. Lights
   j. Redundant mask and knife
   k. Jon-line
5. Dive Tables
   a. Computer generated tables
   b. DCIEM Heliox Tables and / or other published tables
6. Dive Planning
   a. Operational planning
      i. Support
      ii. Teams
   b. Team planning
      i. Gas requirements
      ii. Oxygen limitations
      iii. Inert gas limitations
   c. Emergency planning
      i. Omitted decompression
      ii. Oxygen toxicity
      iii. Analysis and logging
      iv. General
7. Procedures

a. Bottom, travel and decompression gas
    i. Normal operations
    ii. Failure, loss or inadequate emergency procedures
    iii. Analysis and logging

13.11 Required Skill Performance and Graduation Requirements

The following open water skills must be completed by the student during open-water dives. It is recommended that all dives be conducted between 55 metres / 180 feet and 100 metres / 330 feet.

1. Skills review from previous TDI skills requirements including all skills from entry-level mix or extended range

Land Drills

1. Demonstrate familiarity with basic and intermediate hand signals
2. Selection and preparation of equipment suitable for soft overhead environment with long decompression obligations
3. Conduct team oriented drills for lift bag deployment and gas switching procedure
4. Drills for buddy rescue
5. Properly analyze all gas mixtures to be used

Pre-dive Drills

1. Use START* before every dive
2. Stress analysis and mitigation
3. Gas matching among buddy team
4. Demonstrate adequate pre-dive planning
    a. Limits based on personal and team gas consumption
    b. Limits based on oxygen exposures at planned depths for actual mixes
    c. Limits based on inert gas absorption at planned depths with actual mixes

***START is S-drill (OOA drill and Bubble Check), Team (buddy equipment checks), Air (gas matching), Route (entry/exit and planned path underwater), Tables (depth, duration, waypoints and schedule).**

In-water Drills

1. Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet
2. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices
3. Demonstrate competence managing three stage cylinders, either 3 deco gas or 2 deco and extra bottom gas, including drop and recovery while maintaining position in the water column
4. Ability to manage multiple failures in adverse conditions
5. Complete a horizontal breath-hold swim at depth for 20 metres / 66 feet with mask off or blacked out
6. Deploy lift bag while sharing air on buddy's long hose
7. Properly execute the planned dive within all pre-determined limits
8. Demonstrate the proper navigational techniques for the specific dive

9. On 2 of the dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression
10. Demonstrate the proper procedures for switching and isolating a malfunctioning primary regulator; this exercise should not be practiced deeper than 40 metres / 130 feet

In order to complete this course, students must:

1. Satisfactorily complete the TDI Advanced Trimix Course written examination
2. Complete all open water requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution

14. Nitrox Gas Blender

14.1 Introduction

This course provides the training required to allow candidates to competently and safely blend nitrox gas. The objective of this course is to train candidates in the proper techniques, equipment requirements and hazards involved in blending nitrox gases for recreational scuba.

14.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in the blending of nitrox gases, without direct supervision.

14.3 Who May Teach

Any active TDI Nitrox Gas Blender Instructor may teach this course

14.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. N/A

14.5 Student Prerequisites

1. Minimum age 18

14.6 Course Structure and Duration

Open Water Execution

1. N/A

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 2

14.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

14.8 Required Equipment

The following are required for this course:

1. *TDI Nitrox Gas Blending* Manual
2. *TDI Nitrox Gas Blending* PowerPoint Presentation
3. Oxygen (O_2) analyzer, instructor may provide

14.9 Required Subject Areas

The *TDI Nitrox Gas Blending* Manual is mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics.

1. The Responsibility of the Gas Blender
2. Gases of Diving
    a. Air
    b. Oxygen (O_2)
    c. Nitrogen
3. Oxygen Handling
    a. Oxygen (O_2) hazards
    b. Causes and prevention of oxygen (O_2) fire
    c. Oxygen system design
    d. Local regulations for gas blending and handling
4. Gas Production Equipment
    a. Compressors
    b. Cylinders
    c. Filtration systems
    d. Analog gauges
5. Mixing Techniques
    a. General considerations

   b. Continuous blending systems
   c. De-nitrogenated air systems
   d. Pre-mix systems
   e. Partial pressure blending mathematics
6. Oxygen (O_2) Analysis
   a. Procedures
   b. Oxygen (O_2) analyzers
7. Cylinder Handling and Sign Out

14.10 Required Skill Performance and Graduation Requirements

In order to complete this course, students must:

1. Candidates must successfully blend and analyze 5 cylinders of nitrox gas
2. Satisfactorily complete the TDI Nitrox Gas Blender Course written examination
3. Demonstrate understanding of nitrox blending and oxygen analysis

15. Advanced Gas Blender

15.1 Introduction

This course enables the successful candidate to engage in the blending of oxygen and helium based gasses. The objective of this course is to train candidates in the proper procedures needed for the preparation and blending of high quality nitrox and trimix gases for use in technical diving.

15.2 Qualifications of Graduates

Upon successful completion of this course candidates will be able to prepare high quality scuba gases.

15.3 Who May Teach

Any active TDI Advanced Gas Blending Instructor may teach this course

15.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. N/A

15.5 Student Prerequisites

1. Minimum age 18
2. Provide proof of certification as a TDI Nitrox Gas Blender or equivalent

15.6 Course Structure and Duration

Open Water Execution

1. N/A

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 6

15.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

15.8 Training Material

Required material

1. *TDI Advanced Gas Blender* Manual

15.9 Required Equipment

The following are required for this course:

1. Access to a helium analyzer

15.10 Required Subject Areas

The *TDI Advanced Gas Blender* Manual is mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. The Responsibility of the Gas Blender
2. Gases of Diving
    a. Oxygen (O_2)
    b. Nitrogen
    c. Helium
    d. Other gases
3. Oxygen (O_2) Handling
    a. Oxygen (O_2) hazards
    b. Causes and prevention of oxygen (O_2) fire
    c. Oxygen system design
    d. Local regulations for gas blending and handling
    e. Oxygen compatible systems components
4. Gas Production Equipment
    a. Compressors

   b. Cylinders
   c. Filtration systems
   d. Gauges
5. Mixing Techniques
   a. General considerations
   b. Continuous blending systems
   c. Membrane separation systems
   d. Pre-mix systems
   e. Partial pressure blending
      i. Mathematics of partial pressure
      ii. Mixing by weight (optional)
6. Oxygen (O_2) Analysis
   a. Procedures
   b. Oxygen (O_2) analyzers
7. Cylinder Handling and Sign Out

15.11 Required Skill Performance and Graduation Requirements

In order to complete this course, students must:

1. Candidates must successfully blend and analyze a minimum of 5 cylinders of nitrox and 3 cylinders of trimix
2. Satisfactorily completes the TDI Advanced Gas Blender Course written examination
3. Demonstrate proficiency in blending and analysis of nitrox and trimix gases

16. Oxygen (O_2) Equipment Service Technician

16.1 Introduction

This course enables the successful candidate to engage in the preparation of scuba equipment for Technical Diving Gases. The objective of this course is to train candidates in the proper procedures required for oxygen equipment cleaning. This course may be combined with the TDI Visual Inspection Procedures course at the discretion of the instructor. .

16.2 Qualifications of Graduates

Upon successful completion of this course candidates will be able to prepare scuba equipment, according to their certification level. There are two levels of certification, as follows:

1. Equipment O_2 service technician: Qualified to service scuba regulators, cylinders, valves and manifolds for use with EAN and other technical diving gases
2. Cylinder O_2 service technician: Qualified to service scuba cylinders, valves and manifolds for use with EAN and other technical diving gases

16.3 Who May Teach

Any active TDI Service Technician Instructor may teach this course

16.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. N/A

16.5 Student Prerequisites

1. Minimum age 18
2. Provide proof of:
    a. Certification as a TDI Nitrox Gas Blender or equivalent
    b. VIP certification through a recognized agency*
    c. Certification through a recognized manufacturing company regulator clinic**
    d. Employment through a recognized scuba related facility, manufacturer/distributor or proof of intent to acquire such employment

***VIP certification may be offered in combination with this course**

****Not required if training as TDI Cylinder O_2 Service Technician only**

16.6 Course Structure and Duration

Open Water Execution

1. N/A

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level; Visual inspection procedures (VIP) may be combined with this course by O_2 service technician instructors who also hold the VIP instructor rating

Duration

1. The minimum number of classroom and briefing hours is 6

16.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

16.8 Training Material

Required material

1. *TDI Equipment Service Technician* Manual

Optional Material

1. *TDI Equipment Service Technician* PowerPoint Presentation

16.9 Required Equipment

None

16.10 Required Subject Areas

The *TDI Equipment Service Technician* Manual is mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. Required academic subject areas are the same for both levels of certification:

1. The Responsibility of the Service Technician
2. Oxygen (O_2) Handling
    a. Oxygen (O_2) compatible systems components
3. Equipment Servicing
    a. Materials for use in oxygen cleaned systems
        i. Lubricants
        ii. O-rings
        iii. Cleaning chemicals
    b. Procedures of oxygen cleaning
        i. Cylinders
        ii. Valves
        iii. Regulators
        iv. System components
4. Gas Production Equipment
    a. Compressors
    b. Cylinders
    c. Filtration systems
    d. Gauges
5. Mixing Techniques
    a. General considerations
    b. Continuous blending systems
    c. Membrane separation systems
    d. Pre-mix systems
    e. Partial pressure blending
        i. Mathematics of partial pressure
        ii. Mixing by weight (optional)
6. Oxygen (O_2) Analysis
    a. Procedures
    b. Oxygen (O_2) analyzers
7. Cylinder Handling and Sign Out

16.11 Required Skill Performance and Graduation Requirements

In order to complete this course, students must:

1. Candidates must successfully service a cylinder valve and regulator* for enriched air nitrox (EAN) use
2. Satisfactorily complete the TDI Service Technician Course written examination

3. Demonstrate proficiency in servicing scuba equipment for use with enriched air nitrox (EAN)

***Regulator service not required if training as Cylinder O_2 Service Technician only**

Note: To upgrade from TDI Cylinder to TDI Equipment O_2 Service Technician, verification of certification through a recognized manufacturing company regulator clinic is required. Additionally, practical training and evaluation in regulator oxygen servicing must be completed with an active TDI O_2 Service Technician Instructor (+ any associated refresher training required by the instructor), who must then register the certification as per the course administration requirements

17. Cavern Diver

17.1 Introduction

This course is designed to develop the minimum skills and knowledge for cavern and overhead environment diving within the limits of light penetration; in addition outlines specific hazards associated with cave diving. The cavern diver course in not intended to provide instruction for cave diving environments. The objective of this course is to train divers in the proper planning, procedures, techniques and hazards of cavern diving.

17.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in cavern diving activities without direct supervision provided the graduates adhere to the following limits:

1. Daylight zone, i.e. within natural light of the cavern entrance
2. Penetration is limited to 1/3 of a single diving cylinder or 1/6th if using double cylinders
3. 61 linear metres / 200 linear feet from the surface
4. 40 metres / 130 feet maximum depth
5. No decompression diving
6. No restrictions; no areas too small for 2 divers to pass side-by-side
7. Safety stops as appropriate or necessary
8. Maintain a continuous guideline
9. Proper cavern diving equipment is used
10. No removal of life support equipment shall be permitted within the overhead environment

Upon successful completion of this course, graduates are qualified to enroll in:

1. TDI Introductory Cave course

17.3 Who May Teach

Any active TDI Cavern, Intro to Cave or Cave Instructor may teach this course

17.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. A maximum of 6 students per active TDI instructor

Cavern

1. A maximum of 4 students per active TDI Instructor are allowed; ratio should be reduced as required due to environmental or operational constraints

17.5 Student Prerequisites

1. Minimum age 18, 15 with parental consent
2. Provide proof of an SDI Open Water Scuba Diver or equivalent
3. Provide proof of a minimum of 25 dives

17.6 Course Structure and Duration

Water Execution

1. Four cavern dives with a total bottom time of 80 minutes conducted at 2 different sites

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 6
2. Course must be conducted over a minimum of 2 days

17.7 Administrative Requirements

The following are the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment and certifications
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

17.8 Required Equipment

Suggested reading materials:

1. *TDI Diving In Overhead Environments* manual
2. *NACD Art of Safe Cave Diving*
3. *Basic Cave Diving – A Blueprint for Survival*
4. CDAA - *Cavern / Sinkhole Manual*
5. *NSS-CDS Cavern* Manual

The following equipment is required for each student:

1. Primary cylinder, volume appropriate for planned dive and student gas consumption; students are permitted to use double cylinders, but would be limited to the 1/6 air rule

2. Regulator with pressure gauge and alternate air source; although not required, it is suggested one regulator be mounted on a hose approximately 2 metres / 7 feet in length
3. Buoyancy compensator device (BCD) with power inflator, CO_2 device rendered inoperative
4. Exposure suit adequate for cavern environment
5. Mask and fins, **NO** snorkel
6. Line cutting device
7. Safety reel with a minimum of 37 metres / 125 feet of guideline
8. One primary cavern-diving reel with length appropriate for intended dive
9. Two battery powered lights, each with burn time suitable for the planned dive time
10. Computer or watch (bottom timer) and depth gauge
11. Slate or wet notes and pencil
12. Submersible dive tables or backup dive computer (recommended)
13. Three directional line arrows
14. Weight system

Instructor must use full cave diving equipment during all water exercises

17.9 Required Subject Areas

The following topics must be covered during this course:

1. Policy for Cavern Diving
2. Gas Matching Procedures and Management to Include Dissimilar Volume
3. Psychological Considerations
4. Equipment Considerations
    a. Cylinder options
    b. Regulator options
    c. Buoyancy compensator device / harness options
    d. Reel options
    e. Proper weighting
5. Communication
    a. Hand signals
    b. Light signals
    c. Touch contact signals
6. Swimming Techniques
    a. Body posture/ trim
    b. Buoyancy control
    c. Line following
    d. Propulsion techniques
7. Physiology
    a. Breathing techniques
    b. Stress management

8. Cavern environment
    a. Geology
        i. Bottom
        ii. Ceiling
    b. Local access requirements
    c. Land owner relations
9. Cavern Conservation
10. Problem Solving
    a. Emergency procedures
    b. Equipment failure
    c. Silting conditions
11. Accident Analysis
12. Review of Dive Tables and Decompression Theory
13. Cavern Diving Etiquette

17.10 Required Skill Performance and Graduation Requirements

The following land drills must be covered during this course:

1. How to:
    a. Properly deploy a guideline
    b. Properly follow a guideline
    c. Touch contact communicate
    d. Correctly deploy directional markers

The student must perform the following S-drill and skills during all dives:

1. Demonstrate:
    a. Adequate pre-dive planning
    b. Equipment check and equipment matching
    c. Bubble check
    d. Specialized propulsion techniques
    e. Proper buoyancy control
    f. Proper body posture
    g. Proper stress analysis (detection and management)

The student must perform the following in-water skills during cavern dives:

1. Properly deploy a guideline
2. Properly follow a guideline with eyes open and closed; simulating loss of visibility
3. Air share with a buddy with eyes open, following the guideline
4. Air share with a buddy with eyes closed and use touch contact, following the guideline
5. Remove and replace mask while in contact with guideline
6. Demonstrate light / hand -signals and touch contact
7. Explore cavern

8. Referencing as back-up navigation
9. Anti-silting techniques
10. Simulate a primary light failure, and deploy back up light and follow guideline
11. If diver uses a duel valve system, air/gas valve management

Note: No removal of life support equipment shall be permitted within the overhead environment

In order to complete this course, students must:

1. Perform all land drills and cavern dive requirements safely and efficiently
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Maintain an appropriate level of awareness and respect for the cavern environment
4. Log all dives

18. Introductory Cave Diver

18.1 Introduction

This course is an introduction to the basic principles of cave diving utilizing a single primary guide line. Introductory cave diving is the second level in the development of safe techniques for cave diving, directly building upon the cavern diver course. This introduction to cave diving is not intended to train divers for all facets of cave diving. The objective of this course is the perfection of skills taught in the cavern diving program, in addition to the adoption of additional techniques and procedures required for elementary cave dives.

18.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in single guideline cave diving activities without direct supervision provided the graduates adhere to the following limits:

1. Penetration is limited to1/3 of a single diving cylinder or 1/6th if using double cylinders
2. 40 metres / 130 feet maximum depth
3. No decompression diving
4. Maintain a continuous guideline
5. Proper cave diving equipment is used

Upon successful completion of this course, graduates are qualified to enroll in:

1. TDI Cave course

18.3 Who May Teach

Any active TDI Introductory Cave or Cave Instructor may teach this course

18.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Cave Dives

1. A maximum of 3 students per active TDI Instructor are allowed
2. The ratio should be reduced as required due to environmental or operational constraints

18.5 Student Prerequisites

1. Minimum age 18, 15 with parental consent
2. Provide proof of certification as a TDI Cavern Diver or equivalent

18.6 Course Structure and Duration

Water Execution

1. Minimum of 4 single guideline cave dives with a total bottom time of 100 minutes conducted at 2 different sites

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 4
2. Course must be taught over 2 days
3. If this course is combined with a cavern diver course, a minimum of 3 days, 8 dives and 180 bottom time minutes is required

18.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

18.8 Required Equipment

The following are required for this course:

1. *TDI Diving in Overhead Environments* Manual
2. *TDI Diving in Overhead Environments* Instructor Guide
3. *TDI Diving in Overhead Environments* Instructor Resource CD (Optional)

Other suggested reading materials:

1. *NACD Art of Safe Cave Diving*
2. *Basic Cave Diving – A Blueprint for Survival*
3. *CDAA - Cavern / Sinkhole* Manual
4. *NSS-CDS Cave Diving* Manual
5. *The Darkness Beckons* – Martyn Farr
6. *Cavern Measureless to Man*

The following equipment is required for each student:

1. Primary cylinder(s); volume appropriate for planned dive and student gas consumption
2. Dual-orifice (Y) or (H) closed valve or dual valve manifold
3. Two independent first and second stage regulators; one regulator equipped with a long hose at a recommended minimum length of 2 metres / 7 feet
4. Submersible pressure gauge
5. Buoyancy compensator device (BCD) with power inflator
6. Exposure suit adequate for diving environment
7. Mask and fins, **NO** snorkel
8. Line cutting device
9. Three battery powered lights; 1 primary and 2 back-ups, each with a with burn time suitable for the planned dive time
10. Safety reel with a minimum of 37 metres / 125 feet of guideline
11. One primary cave-diving reel with length appropriate for intended dive
12. Computer, watch or bottom timer and depth gauge
13. Slate or wet notes with a pencil
14. Submersible dive tables or backup dive computer
15. Three directional line arrows

Instructor must use full cave diving equipment during all water exercises

18.9 Required Subject Areas

The following topics must be covered during this course:

1. Policy for Cave Diving
2. Gas Matching Procedures and Management to Include Dissimilar Volumes
3. Psychological Considerations
4. Equipment Considerations
    a. Cylinder options
    b. Regulator options
    c. Buoyancy compensator device (BCD) / harness options
    d. Reel options
    e. Proper weighting
    f. Equipment configurations
5. Communication
    a. Hand signals
    b. Light signals
    c. Touch contact signals
6. Swimming Techniques
    a. Body posture/ trim
    b. Buoyancy control

c. Line following
d. Propulsion techniques

7. Physiology
    a. Breathing techniques
    b. Stress management
8. Cave Environment
    a. Geology
        i. Bottom
        ii. Ceiling
    b. Local access requirements
    c. Land owner relations
9. Conservation
10. Problem Solving
    a. Emergency procedures
    b. Equipment failure
    c. Silting conditions
11. Accident Analysis
12. Review of Dive Tables and Decompression Theory
13. Cave Diving Etiquette
14. Required Skill Performance and Graduation Requirements

18.10 Required Skill Performance and Graduation Requirements

The following land drills must be covered during this course:

1. How to properly deploy a guideline
2. How to properly follow a guideline
3. Use of safety reel in lost diver procedures
4. Use of safety reel in lost line drill

The student must perform the following S-drill and skills during all dives:

1. Demonstrate:
    a. Adequate pre-dive planning
    b. Equipment check and equipment matching
    c. Bubble check
    d. Specialized propulsion techniques in varying types of flow
    e. Proper buoyancy control
    f. Proper body posture
    g. Proper stress analysis (detection and management)

The student must perform the following in-water skills during cave dives:

1. Properly deploy a guideline
2. Properly use line markers

3. Properly follow a guideline with eyes open and closed, simulating loss of visibility
4. Air share with a buddy with eyes open, following the guideline
5. Air share with a buddy with lights off, eyes closed and use touch contact, following the guideline
6. Remove and replace mask while in contact with guideline
7. Demonstrate light / hand -signals and touch contact
8. Conservation and awareness techniques
9. Referencing as back-up navigation
10. Demonstrate adequate anti-silting techniques
11. Simulate a primary light failure, and use back light to exit the cave
12. Demonstrate lost line and lost diver drills

In order to complete this course, students must:

1. Satisfactorily complete the TDI Intro Cave Diver Course written examination
2. Perform all land drills and cave dive requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution
4. Maintain an appropriate level of awareness and respect for the cavern environment
5. Log all dives

19. Full Cave Diver

19.1 Introduction

This course is the third stage of training in the series of TDI's Cave Diver development program. Advanced cave dive planning, the practical execution of different types of cave systems and scenarios divers encounter are presented. This cave diving course is not intended to prepare divers for evaluating all facets of cave diving. The objective of this course is to expand and critique previous skills accomplished in the TDI Cavern and Introductory Cave Diving programs. Emphasis is placed upon dive planning and skill perfection through actual cave penetration.

19.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in cave diving activities without direct supervision provided the graduates adhere to the following limits:

1. Penetration is limited to the 1/3 air rule
2. 40 metres / 130 feet maximum depth
3. No equipment removal in cave
4. Safety and decompression stops as appropriate or necessary if trained as TDI Decompression Procedures Diver or Equivalent
5. Maintain a continuous guideline
6. Proper cave diving equipment is used

19.3 Who May Teach

This course may be taught by any active TDI Cave Diving Instructor

19.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Cave Dives

1. A maximum of 3 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

19.5 Student Prerequisites

1. Minimum age 18
2. Minimum certification as a TDI Introductory Cave Diver or equivalent

3. If Decompression dives are to be conducted in training, student must be TDI Decompression Procedures certified or this training may conducted concurrently. If courses are taught concurrently, ALL requirements for both courses must be met and registrations processed upon completion

19.6 Course Structure and Duration

Open Water Execution

1. 8 cave dives are required with a minimum accumulated bottom time of 240 minutes at 3 different sites
2. At least 1 of these sites should be a location not utilized in training during the cavern or introductory cave courses
3. For divers entering the cave program without cavern / introductory cave diving certification, 16 cave dives with 420 minutes of total bottom, not including decompression time, are required

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The suggested number of classroom and briefing hours is 6
2. Course must be taught in no less than 4 days
3. If the TDI Cavern and Intro to Cave diving courses are combined, course must be 7 days long

19.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment and certifications
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

19.8 Required Equipment

The following are the required for this course:

1. *TDI Diving in Overhead Environments* Manual
2. *TDI Diving in Overhead Environments* Instructor Guide
3. *TDI Diving in Overhead Environments* Instructor Resource CD (Optional)

Other suggested reading materials:

1. *NACD Art of Safe Cave Diving*

2. *Basic Cave Diving – A Blueprint for Survival*
3. *CDAA - Cavern / Sinkhole* Manual
4. *NSS – CDS Cave Diving* Manual
5. *Cavern Measureless to Man*
6. *The Darkness Beckons* – Martyn Farr

The following equipment is required for each student:

1. Dual cylinders, volume appropriate for planned dive, student gas consumption
2. Two independent first and second stage regulators; one regulator equipped with a long hose at a recommended minimum length of 2 metres / 7 feet
3. Submersible pressure gauge
4. Buoyancy compensator device (BCD) with power inflator
5. Exposure suit adequate for diving environment
6. Mask and fins, **NO** snorkel
7. Two line cutting devices
8. Three battery powered lights; 1 primary and 2 back-ups, each with a with burn time suitable for the planned dive time
9. One primary cave-diving reel with length appropriate for intended dive
10. Computer, watch or bottom timer and depth gauge
11. Slate or wet notes with a pencil
12. Submersible dive tables or back up dive computer
13. Three directional line arrows
14. One non- directional line marker
15. Gap reel with 15 metres / 50 feet of guideline
16. It is recommended that the team properly mark decompression cylinders and stage them, in any dive where decompression is planned, at least 1 stop deeper than the planned decompression obligation

Instructor must use full cave diving equipment during all water exercises

19.9 Required Subject Areas

The following topics must be covered during this course:

1. Policy for Cave Diving
2. Gas Matching Procedures and Management to Include Dissimilar Volumes
3. Psychological Considerations
4. Equipment Considerations
    a. Cylinder options
    b. Regulator options
    c. Buoyancy compensator device/ harness options
    d. Reel options
    e. Proper weighting
    f. Equipment configurations

5. Communication
    a. Hand signals
    b. Light signals
    c. Touch contact signal
6. Swimming Techniques
    a. Body posture/ trim
    b. Buoyancy control
    c. Line following
    d. Propulsion techniques
7. Physiology
    a. Breathing techniques
    b. Stress management
    c. Decompression theory and its application to cave diving
8. Cave Environment
    a. Geology
        i. Bottom
        ii. Ceiling
    b. Local access requirements
    c. Land owner relations
9. Conservation
10. Problem Solving
    a. Emergency procedures
    b. Equipment failure
    c. Silting conditions
11. Accident Analysis
12. Review of Dive Tables and Decompression Theory
13. Cave Diving Etiquette

19.10 Required Skill Performance and Graduation Requirements

The following land drills must be covered during this course:

1. How to properly deploy a guideline
2. How to properly follow a guideline
3. Use of safety reel in lost diver procedures
4. Use of safety reel in lost line drill

The student must perform the following S-drill and skills during all dives:

1. Demonstrate adequate pre-dive planning
2. Equipment check and equipment matching
3. Bubble check
4. Demonstrate specialized propulsion techniques in varying types of flow

5. Demonstrate proper buoyancy control
6. Demonstrate proper body posture
7. Demonstrate proper stress analysis (detection and management)

The student must perform the following in-water skills during cave dives:

1. Properly deploy a guideline
2. Properly use directional and non directional line markers
3. Properly follow a guideline with eyes open and closed (simulating loss of visibility)
4. Air share with a buddy with eyes open , following the guideline
5. Air share with a buddy with lights off and eyes closed and use touch contact, following the guideline
6. Remove and replace mask while in contact with guideline
7. Demonstrate light / hand -signals and touch contact
8. Conservation and awareness techniques
9. Referencing as back-up navigation
10. Demonstrate adequate anti-silting techniques
11. Simulate a primary light failure, and use back light to exit the cave
12. Demonstrate lost line and lost diver drills
13. Demonstrate to use of reels to perform jumps and gaps required in circuits and traverses to maintain a continuous guideline to open water

In order to complete this course, students must:

1. Satisfactorily complete the TDI Cave Diver Course written examination
2. Perform all land drills and cave dive requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution
4. Maintain an appropriate level of awareness and respect for the cavern environment
5. Log all dives

20. Underwater Cave Surveying Diver

20.1 Introduction

This course is designed to give the trained cave diver the minimum knowledge and basic fundamentals of how to survey in the unique underwater cave environment. The intention of this program is to encourage a standardization of cave surveying on all projects; encourage the use of cave maps in dive planning while increasing the diver's awareness and knowledge of the surroundings in this environment. Safe techniques, procedures and skill perfection associated with surveying in cave diving is emphasized.

20.2 Who May Teach

This course may be taught by any active TDI Underwater Cave Surveying Instructor.

20.3 Qualifications of Graduates / Limits of Training

Upon successful completion of this course, graduates may engage in cave surveying diving activities without direct supervision, so long as the following limits are adhered to:

1. Penetration is limited to one-third air rule, or more conservative air-plan at the instructor's discretion
2. 39 metres/ 130 feet maximum depth
3. 6 metres / 20 feet minimum starting visibility
4. No equipment removal in the cave
5. Students are encouraged to gain experience before attempting to plan and execute complex cave dives
6. Perform safety and decompression stops appropriate or necessary

20.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter.

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 2 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

20.5 Student Prerequisites

1. Minimum age 18
2. Provide proof of a TDI Full Cave Diver certification or equivalent
3. Provide proof of at least 25 non-training full cave dives

20.6 Course Structure and Duration

Open Water Execution

1. TDI allows instructors to structure courses according to the number of students participating and their skill level. Adequate time to ensure comprehension and ability to perform skills is required.

Course Structure

1. Two survey cave dives are required with a minimum accumulated bottom time of 60 minutes

Duration

1. The suggested number of classroom and briefing hours is 8; minimum number of days to complete the program is 2

Administrative Tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

20.7 Required Materials

1. *Basic Underwater Cave Surveying* by John Burge, NSS-CDS
2. Note pad and pencils
3. Basic calculator (can square and exact square roots) or scientific calculator
4. Scaling ruler
5. Graph paper
6. Circular protractor

20.8 Required Equipment

The following equipment is required for each student:

1. Primary cylinders, minimum volume is 22 litres / 160 cubic ft, manifold system recommended
2. Two independent first and second stage regulators; one regulator equipped with a long hose at a recommended minimum length of 2 metres / 7 feet
3. Submersible pressure gauge
4. Buoyancy compensator device (BCD) with power inflator
5. Exposure suit adequate for diving environment
6. Mask and fins, NO snorkel

7. Line cutting device
8. Three battery powered lights; 1 primary and 2 back-ups, each with a with burn time suitable for the planned dive time
9. Slate or wet notes with a pencil
10. Submersible dive tables or backup dive computer
11. Safety reel with a minimum of 37 metres / 125 feet of guideline
12. One primary cave-diving reel with length appropriate for intended dive
13. Jump/Gap reel 15 metres / 50 feet of line
14. Three directional line arrows
15. One non-directional marker
16. Underwater compass and bulls-eye level mounted on slate

Note: It is recommended the team pre-position decompression cylinders approximately 1 stop deeper than the planned decompression depth on any dive where decompression is planned. Cylinders should be clearly marked and easily identifiable, even in no-visibility conditions. Each cylinder must have a regulator and submersible pressure attached.

Note: It is recommended the instructor have oxygen and first aid kit available for the surface support. In addition adequate drinking fluids should be available for all students, instructional staff and surface support personnel to prevent dehydration.

20.9 Required Subject Areas

1. Decompression Theory and its Application to Survey diving
2. Gas Matching Procedures/Management
3. Accident Analysis
4. Equipment Considerations
    a. Compass readings
    b. Compass errors
    c. Streamlining
5. Body Posture and Buoyancy Control
6. Survey Techniques
    a. Sketching
    b. Tie-off stations
    c. Vertical surveying
    d. Large chambers
    e. Extended passages
    f. Radial surveys
7. Review of Problem Solving
    a. Emergency procedures
        i. Line following
        ii. Team separation
        iii. Communication

8. Survey Process
    a. Data collection
    b. Data verification
    c. Data preparation
9. Symbolism
10. Cartography
    a. Single line maps
    b. High grade maps
11. Cave Environment/Conservation
12. Land Owner Relations
13. Local Access Requirements

20.10 Required Skill Performance and Graduation Requirements

The student must complete the following in-water skills during the survey cave dives:

1. Demonstrate adequate pre-dive planning
2. Equipment check and S-drill should be second nature with each dive
3. Demonstrate proper use of guideline and reels
4. Students are to critique their own dives while the instructor supervises this process
5. The maximum depth for this course is 40 metres / 130 feet

Note: A continuous guideline to open water must be maintained on all cave dives

Note: A reckless or cavalier attitude may constitute grounds for denying certification, regardless of technical ability

Note: Certifications may be denied if it is determined the course was not conducted according to the standards established by TDI.

In order to complete the course the student must:

1. Complete all land drills and cave dive requirements safely and efficiently
2. Demonstrate mature and sound judgment, concerning dive planning and execution
3. Maintain an appropriate level of awareness and respect for the cave environment
4. Log all dives
5. Receive the recommendation for certification by the instructor

20.11 Instructor Requirements

To qualify to teach the TDI Cave Survey Diver Course, the instructor must:

1. Be an active TDI Full Cave Diving Instructor for at least 1 year
2. Have taught at least 5 complete cave diver courses

3. Provide proof of at least 25 logged survey dives
4. Co-taught at least 1 TDI Underwater Cave Survey Diver Course with and active TDI Underwater Cave Survey Diver Instructor
5. Published or be a key member of at least 1 cave survey project

21. DPV Cave Diver

21.1 Introduction

This course is designed to teach trained cave divers how to utilize Diver Propulsion Vehicles (DPVs) in the cave environment. Divers will learn about safe DPV use, DPV components, and care and maintenance. Students will learn to plan dives that may incorporate extended penetration, longer bottom times, complex dive planning, and proper methods of gas management.

21.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in DPV cave diving activities without direct supervision so long as the following limits are adhered to:

1. If each diver utilizes a single DPV, each diver must turn the dive with no less than twice the amount of gas required to exit the cave while swimming
2. If each diver utilizes multiple DPVs, each diver must turn the dive with no less than twice the amount of gas required to exit the cave while utilizing the DPV
3. No equipment removal in cave with exception of stage bottles if utilized
4. 39 metres /130 feet maximum depth
5. Students are encouraged to gain experience before attempting to plan and execute complex DPV cave dives
6. Safety and decompression stops are completed as appropriate or necessary

21.3 Who May Teach

1. An active TDI DPV Cave Instructor.

21.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. NA

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 2 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate.

21.5 Student Prerequisites

1. Minimum age 18
2. Certified as a TDI Full Cave Diver or equivalent

3. Provide proof of at least 25 non-training full cave dives

21.6 Course Structure and Duration

Open Water Execution

1. Students must complete 3 stage cave dives with a minimum accumulated bottom time of 90 minutes.

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 4

21.7 Administrative Requirements

Administrative Tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

21.8 Required Equipment

The following material is required:

1. NA

The following equipment is required for each student:

1. Dual cylinders, volume appropriate for planned dive, student gas consumption
2. Two independent first and second stage regulators; one regulator equipped with a long hose at a recommended minimum length; 2 metres / 7 feet
3. Submersible pressure gauge
4. Buoyancy compensator device (BCD) with power inflator
5. Exposure suit adequate for diving environment
6. Mask and fins, NO snorkel
7. Two line cutting devices
8. Three battery powered lights; 1 primary and 2 back-ups, each with a with burn time suitable for the planned dive time

9. One primary cave-diving reel with length appropriate for intended dive
10. Safety reel with a minimum of 37 metres / 125 feet of guideline
11. Appropriate number of gap and jump reels with 15 metres / 50 feet of guideline
12. Computer, watch or bottom timer and depth gauge
13. Slate or wet notes with a pencil
14. Submersible dive tables or back up dive computer
15. Three directional line arrows
16. One non-directional line marker
17. DPV adequately configured for the cave environment

Instructor must use full cave diving equipment during all water exercises

21.9 Required Subject Areas

The following topics must be covered during this course:

1. Motivations for DPV cave diving
2. Advantages of DPV use
3. Equipment considerations
    a. DPV options
    b. DPV components
    c. Rated burn time
    d. Care and Maintenance
    e. DPV rigging
    f. Helmets
4. Problem solving procedures
    a. DPV malfunction or failure
    b. Towing
    c. Gas sharing with DPVs
    d. Light failure
    e. Entanglement
    f. Collision avoidance
    g. Team separation
5. Environmental considerations
    a. Appropriate vs. inappropriate passages
    b. Suitable cave conditions
    c. Low impact DPV use
6. DPV diving techniques
    a. Buoyancy and trim with DPV
    b. Dropping, securing, and retrieving a DPV
    c. Installing guidelines with a DPV

d. Instigating directional and depth changes
e. DPV courtesy and etiquette

7. Dive planning and gas management
    a. Turn time, turn distance, and turn pressure
    b. Gas mix(es) and NDLs or decompression obligations

21.10 Required Skill Performance and Graduation Requirements

The student must perform the following S-drill and skills during all dives:

1. Demonstrate adequate pre-dive planning
2. Equipment check and equipment matching
3. Bubble check
4. Demonstrate specialized propulsion techniques in varying types of flow
5. Demonstrate proper buoyancy control
6. Demonstrate proper body posture
7. Demonstrate proper stress analysis (detection and management)

The student must perform the following in-water skills during cave dives:

1. Share gas with DPVs while maintaining visual contact with the guideline.
2. Simulate primary light failure and exit utilizing the DPV and the smallest backup light
3. Simulate exiting the cave with disabled DPV
4. Exit while towing a team member and his disabled DPV

In order to complete this course, students must:

1. Perform all dive requirements safely and efficiently
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Maintain an appropriate level of awareness and respect for the cavern environment
4. Log all dives

21.11 Instructor Requirements

To qualify to teach the TDI DPV Cave Diver Course, the instructor must:

1. Be an active TDI Full Cave Diving Instructor for at least 1 year
2. Have taught at least 5 complete cave diver courses
3. Provide proof of at least 25 logged DPV cave dives
4. Co-taught at least 1 TDI DPV Diver Course with and active TDI DPV Diver Instructor

22. Stage Cave Diver

22.1 Introduction

This course is designed to teach trained cave divers how to extend bottom times and/or penetration distance through the use of stage cylinders. Divers will learn to plan dives that may incorporate longer bottom times, complex dive planning, and multiple methods of gas management. With respect to depth, gas mixes, and required decompression, course dives will not exceed the student's current level of certification and experience level.

22.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in stage cave diving activities without direct supervision so long as the following limits are adhered to:

1. Penetration *is* limited to the 1/3 air rule, or more conservative air-plan at instructor's discretion.
2. No equipment removal in cave with exception of stage cylinders.
3. Students are encouraged to gain experience before attempting to plan and execute complex stage cave dives.
4. Safety and decompression stops are completed as appropriate or necessary.

22.3 Who May Teach

An active TDI Stage Cave Instructor.

22.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to insure comprehensive and complete training of subject matter.

Confined Water (Swimming pool-like conditions)

1. NA

Open Water (Ocean, lake, quarry, spring, river or estuary)

1. A maximum of 3 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate.

22.5 Student Prerequisites

1. Minimum age 18
2. Certified as a TDI Full Cave Diver or equivalent

22.6 Course Structure and Duration

Open Water execution

1. Students must complete 3 stage cave dives with a minimum accumulated bottom time of 90 minutes utilizing two different cave entrances.

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 4

22.7 Administrative Requirements

Administrative Tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

22.8 Required Equipment

The following material is required:

1. NA

The following equipment is required for each student:

1. Dual cylinders, volume appropriate for planned dive, student gas consumption
2. Two independent first and second stage regulators; one regulator equipped with a long hose at a recommended minimum length, 2 metres / 7 feet
3. Submersible pressure gauge
4. Stage cylinder(s), volume appropriate for planned dive, student gas consumption
5. Stage regulator(s) including first and second stage and submersible pressure gauge
6. Buoyancy compensator device (BCD) with power inflator
7. Exposure suit adequate for diving environment
8. Mask and fins, NO snorkel
9. Two line cutting devices

10. Three battery powered lights; 1 primary and 2 back-ups, each with a with burn time suitable for the planned dive time
11. One primary cave-diving reel with length appropriate for intended dive
12. Safety reel with a minimum of 37 metres / 125 feet of guideline
13. Appropriate number of gap and jump reels with 15 metres / 50 feet of guideline
14. Computer, watch or bottom timer and depth gauge
15. Slate or wet notes with a pencil
16. Submersible dive tables or back up dive computer
17. Three directional line arrows
18. One non-directional line marker

Instructor must use full cave diving equipment during all water exercises

22.9 Required Subject Areas

The following topics must be covered during this course:

1. Motivations for extended time and penetration
2. Equipment considerations
    a. Cylinder sizes
    b. Rigging
    c. Streamlining
3. Gas planning and gas management techniques
4. Dive planning including decompression obligations
5. Stage Diving techniques suitable for the cave environment
    a. Dropping and retrieving of stage cylinders
    b. Drop-off stations

22.10 Required Skill Performance And Graduation Requirements

The student must perform the following S-drill and skills during all dives:

1. Demonstrate adequate pre-dive planning
2. Equipment check and equipment matching
3. Bubble check
4. Demonstrate specialized propulsion techniques in varying types of flow
5. Demonstrate proper buoyancy control
6. Demonstrate proper body posture
7. Demonstrate proper stress analysis (detection and management)

The student must perform the following in-water skills during cave dives:

1. Demonstrate proper use of stage cylinders.
2. Dropping and retrieval of stage cylinders efficiently while swimming.

In order to complete this course, students must:

1. Perform all dive requirements safely and efficiently
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Maintain an appropriate level of awareness and respect for the cavern environment
4. Log all dives

22.11 Instructor Requirements

To qualify to teach the TDI Stage Cave Diver Course, the instructor must:

1. Be an active TDI Full Cave Diving Instructor for at least 1 year
2. Have taught at least 5 complete cave diver courses
3. Provide proof of at least 25 logged stage penetration dives
4. Co-taught at least 1 TDI Stage Cave Diver Course with and active TDI Stage Cave Diver Instructor

23. Mine Diver Level I

23.1 Introduction

This course is the first stage in the TDI Mine Diver development program and is an introduction to the basic principles of mine diving utilizing a single primary guide line. This introduction is not intended to train divers for all facets of mine diving. The objective of this course is the perfection of skills taught in the TDI Cavern Diving program, in addition to the adoption of additional techniques and procedures required for elementary mine dives. This course may be combined with TDI Mine Diver Level II at the discretion of the instructor.

This course uses the same principles and techniques as the TDI Intro to Cave course, including utilizing the same training materials and equipment. However, dual certification is not permitted and graduates wishing to dive in caves must complete the TDI Intro to Cave course.

23.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in single guideline Mine diving activities without direct supervision, provided the graduates adhere to the following limits:

1. Penetration is limited to 1/3 of a single diving cylinder, or 1/6th if using double cylinders
2. 40 metres / 130 feet maximum depth
3. No decompression diving
4. Maintain a continuous guideline
5. Proper mine diving equipment is used
6. Upon successful completion of this course, graduates are qualified to enroll in:
    a. TDI Mine Diver Level II course

23.3 Who May Teach

Any active TDI Mine Diving Instructor specifically authorized by the HQ Training Department. Minimum criteria to be considered for authorization are: TDI Full Cave Instructor with a verifiable minimum of 30 mine dives

23.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Mine Dives

1. A maximum of 3 students per active TDI Instructor are allowed
2. The ratio should be reduced as required due to environmental or operational constraints

23.5 Student Prerequisites

1. Minimum age 18
2. Certified TDI Cavern Diver or equivalent

23.6 Course Structure and Duration

Water Execution

1. Minimum of 4 single guideline mine dives with a total bottom time of 100 minutes conducted at 2 different sites (different water entry points in the same mine system may be considered a different site for Mine Diver Level I training if they are at least 50 metres / 165 feet apart)
2. If the student is already certified as a TDI Intro to Cave or Full Cave Diver, a maximum of 2 dives may be credited towards Mine Diver Level I training at the discretion of the instructor
3. If combined with Mine Diver Level II, a total of 12 dives with a total minimum bottom time of 340 minutes must be conducted over a minimum of 6 days.

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 4
2. Course must be taught over 2 days

23.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

23.8 Training Material

Required Material

1. *TDI Diving in Overhead Environments* Manual
2. *TDI Diving in Overhead Environments* Instructor Guide
3. *TDI Diving in Overhead Environments* Instructor Resource CD (Optional)

Optional Material

1. *NACD Art of Safe Cave Diving*
2. *Basic Cave Diving – A Blueprint for Survival*
3. *CDAA - Cavern / Sinkhole Manual*
4. *NSS-CDS Cave Diving Manual*
5. *The Darkness Beckons* – Martyn Farr
6. *Cavern Measureless to Man*

23.9 Required Equipment

The following equipment is required for each student:

1. Primary cylinder(s); volume appropriate for planned dive and student gas consumption
2. Dual-orifice (Y) or (H) closed valve or dual valve manifold
3. Two independent first and second stage regulators; one regulator equipped with a long hose at a recommended minimum length of 2 metres / 7 feet
4. Submersible pressure gauge
5. Buoyancy compensator device (BCD) with power inflator
6. Exposure suit adequate for diving environment
7. Mask and fins, NO snorkel
8. Line cutting device
9. Three battery powered lights; 1 primary and 2 back-ups, each with a with burn time suitable for the planned dive time
10. Safety reel with a minimum of 37 metres / 125 feet of guideline
11. One primary cave-diving reel with length appropriate for intended dive
12. Computer, watch or bottom timer and depth gauge
13. Slate or wet notes with a pencil
14. Submersible dive tables or backup dive computer
15. Three directional line arrows

Required equipment is the same as TDI Intro to Cave diver. Instructor must use equipment required for TDI Full Cave diving during all water exercises

23.10 Required Subject Areas

The following topics must be covered during this course:

1. Policy for Mine/Cave Diving
2. Gas Matching Procedures and Management to Include Dissimilar Volumes
3. Psychological Considerations
4. Equipment Considerations
    a. Cylinder options
    b. Regulator options
    c. Buoyancy compensator device (BCD) / harness options

   d. Reel options
   e. Proper weighting
   f. Equipment configurations
5. Communication
   a. Hand signals
   b. Light signals
   c. Touch contact signals
6. Swimming Techniques
   a. Body posture/ trim
   b. Buoyancy control
   c. Line following
   d. Propulsion techniques
7. Physiology
   a. Breathing techniques
   b. Stress management
8. Mine Environment
   a. Types of mines
   b. Geology
      i. Bottom
      ii. Ceiling
   c. Structure
   d. Hazards
   e. Local access requirements
   f. Land owner relations
9. Conservation
10. Problem Solving
    a. Emergency procedures
    b. Equipment failure
    c. Silting conditions
11. Accident Analysis
12. Review of Dive Tables and Decompression Theory
13. Mine /Cave Diving Etiquette

23.11 Required Skill Performance and Graduation Requirements

As much of the following information as possible must be determined/obtained and utilized in dive planning:

1. What material(s) were extracted from the mine and by what method(s)
2. Were toxic solutions or substances used or created during the extraction process and is there a risk of such substance(s) remaining or of any general pollution. If so, ascertain which location(s)
3. Obtain a detailed map of the mine from the mining company or whoever is responsible for the site

4. Are there any known or potentially collapsible tunnels?
5. All known access and egress points from the mine, their depths and possible emergency traverses to other exits
6. Type(s) of sediment in the mine
7. Type of ceiling supports; ie wooden or metal and how to detect signs of wear, type of debris left in the mine
8. All possible entanglement points
9. Location, size and depth of vertical extraction shafts
10. Points that could damage divers' delicate equipment such as lines, dry suits, etc
11. Line options
12. How to evaluate the stability of a passage
13. Existing collapse points
14. Special equipment requirements
15. Type of entry/exit

Land Drills

1. How to properly:
    a. Deploy a guideline
    b. follow a guideline
2. Use of safety reel in:
    a. Lost diver procedures
    b. Lost line drill

The student must perform the following S-drill and skills during all dives:

1. Demonstrate:
    a. Adequate pre-dive planning
    b. Equipment check and equipment matching
    c. Bubble check
    d. Specialized propulsion techniques in varying types of flow
    e. Proper buoyancy control
    f. Proper body posture
    g. Proper stress analysis (detection and management)

In-water skills

1. Properly deploy a guideline
2. Properly use line markers
3. Properly follow a guideline with eyes open and closed, simulating loss of visibility
4. Air share with a buddy with eyes open, following the guideline
5. Air share with a buddy with lights off, eyes closed and use touch contact, following the guideline
6. Remove and replace mask while in contact with guideline
7. Demonstrate light / hand -signals and touch contact
8. Conservation and awareness techniques

9. Referencing as back-up navigation
10. Demonstrate adequate anti-silting techniques
11. Simulate a primary light failure, and use back light to exit the mine
12. Demonstrate lost line and lost diver drills
13. Identify and avoid potential hazard, entanglement and collapse points

In order to complete this course, students must:

1. Satisfactorily complete the TDI Intro Cave Diver Course written examination ***(this requirement may be waived by the instructor if the student is already TDI Intro to Cave certified)***
2. Perform all land drills and mine dive requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution
4. Maintain an appropriate level of awareness and respect for the mine environment
5. Log all dives

23.12 Permission to Dive

Before conducting training in any man-made environment, permission must be obtained from whoever is responsible for the site; for example the mine owner/operator, government department, etc. Additionally, the relevant local emergency services should be informed of the activity prior to commencement.

24. Mine Diver Level II

24.1 Introduction

This course is the second stage of training in the TDI Mine Diver development program. This course is not intended to prepare divers for evaluating all facets of mine diving. The objective of this course is to expand and critique previous skills accomplished in the TDI Cavern and Mine Diver Level I programs. Emphasis is placed upon dive planning and skill perfection through actual mine penetration. This course may be combined with TDI Mine Diver Level I at the discretion of the instructor.

This course uses the same principles and techniques as the TDI Full Cave course, including utilizing the same training materials and equipment. However, dual certification is not permitted and graduates wishing to dive in caves must complete the TDI Full Cave course.

24.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in mine diving activities without direct supervision provided the graduates adhere to the following limits:

1. Penetration is limited to the 1/3 air rule
2. 40 metres / 130 feet maximum depth
3. No equipment removal in mine
4. Safety and decompression stops appropriate or necessary, within the current qualification of student(s) and instructor(s)
5. Maintain a continuous guideline
6. Proper mine diving equipment is used

24.3 Who May Teach

Any active TDI Mine Diving Instructor specifically authorized by the HQ Training Department. Minimum criteria to be considered for authorization are TDI Full Cave Instructor with a verifiable minimum of 30 mine dives

24.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Cave Dives

1. A maximum of 3 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

24.5 Student Prerequisites

1. Minimum age 18
2. Certified TDI Mine Diver Level I

24.6 Course Structure and Duration

Open Water Execution

1. 8 mine dives are required with a minimum accumulated bottom time of 240 minutes at 3 different sites (different water entry points in the same mine system may be considered a different site for Mine Diver Level II training if they are at least 100 metres / 330 feet apart)
2. At least 1 of these sites should be a location not utilized in training during the student's Mine Diver Level I course
3. If the student is already certified as a TDI Mine Diver Level I or TDI Full Cave Diver, a maximum of 2 dives may be credited towards Mine Diver Level II training at the discretion of the instructor
4. If combined with Mine Diver Level I, a total of 12 dives with a total minimum bottom time of 340 minutes must be conducted over a minimum of 6 days

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The suggested number of classroom and briefing hours is 6
2. Course must be taught in no less than 4 days

24.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment and certifications
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

24.8 Training Material

Required Material

1. *TDI Diving in Overhead Environments* Manual
2. *TDI Diving in Overhead Environments* Instructor Guide

3. *TDI Diving in Overhead Environments* Instructor Resource CD (Optional)

Optional Material

1. *NACD Art of Safe Cave Diving*
2. *Basic Cave Diving – A Blueprint for Survival*
3. *CDAA - Cavern / Sinkhole* Manual
4. *NSS – CDS Cave Diving* Manual
5. *Cavern Measureless to Man*
6. *The Darkness Beckons* – Martyn Farr

24.9 Required Equipment

The following equipment is required for each student:

1. Dual cylinders, volume appropriate for planned dive, student gas consumption
2. Two independent first and second stage regulators; one regulator equipped with a long hose at a recommended minimum length of 2 metres / 7 feet
3. Submersible pressure gauge
4. Buoyancy compensator device (BCD) with power inflator
5. Exposure suit adequate for diving environment
6. Mask and fins, NO snorkel
7. Two line cutting devices
8. Three battery powered lights; 1 primary and 2 back-ups, each with a with burn time suitable for the planned dive time
9. One primary cave-diving reel with length appropriate for intended dive
10. Computer, watch or bottom timer and depth gauge
11. Slate or wet notes with a pencil
12. Submersible dive tables or back up dive computer
13. Three directional line arrows
14. One non- directional line marker
15. Gap reel with 15 metres / 50 feet of guideline
16. It is recommended that the team properly mark decompression cylinders and stage them, in any dive where decompression is planned, at least 1 stop deeper than the planned decompression obligation

Required equipment is the same as TDI Full Cave diver. Instructor must use equipment required for TDI Full Cave diving during all water exercises

24.10 Required Subject Areas

The following topics must be covered during this course:

1. Policy for Mine/Cave Diving
2. Gas Matching Procedures and Management to Include Dissimilar Volumes
3. Psychological Considerations
4. Equipment Considerations

   a. Cylinder options
   b. Regulator options
   c. Buoyancy compensator device (BCD) / harness options
   d. Reel options
   e. Proper weighting
   f. Equipment configurations
5. Communication
   a. Hand signals
   b. Light signals
   c. Touch contact signal
6. Swimming Techniques
   a. Body posture/ trim
   b. Buoyancy control
   c. Line following
   d. Propulsion techniques
7. Physiology
   a. Breathing techniques
   b. Stress management
   c. Decompression theory and its application to mine diving
8. Mine Environment
   a. Types of mines
   b. Geology
      i. Bottom
      ii. Ceiling
   c. Structure
   d. Hazards
   e. Local access requirements
   f. Land owner relations
9. Conservation
10. Problem Solving
    a. Emergency procedures
    b. Equipment failure
    c. Silting conditions
11. Accident Analysis
12. Review of Dive Tables and Decompression Theory
13. Mine/Cave Diving Etiquette

24.11 Required Skill Performance and Graduation Requirements

As much of the following information as possible must be determined/obtained and utilized in dive planning:

1. What material(s) were extracted from the mine and by what method(s)
2. Were toxic solutions or substances used or created during the extraction process and is there a risk of such substance(s) remaining or of any general pollution. If so, ascertain which location(s)
3. Obtain a detailed map of the mine from the mining company or whoever is responsible for the site
4. Are there any known or potentially collapsible tunnels?
5. All known access and egress points from the mine, their depths and possible emergency traverses to other exits
6. Type(s) of sediment in the mine
7. Type of ceiling supports; ie wooden or metal and how to detect signs of wear, type of debris left in the mine
8. All possible entanglement points
9. Location, size and depth of vertical extraction shafts
10. Points that could damage divers' delicate equipment such as lines, dry suits, etc
11. Line options
12. How to evaluate the stability of a passage
13. Existing collapse points
14. Special equipment requirements
15. Type of entry/exit

Land Drills

1. How to properly deploy a guideline
2. How to properly follow a guideline
3. Use of safety reel in lost diver procedures
4. Use of safety reel in lost line drill

The student must perform the following S-drill and skills during all dives:

1. Demonstrate adequate pre-dive planning
2. Equipment check and equipment matching
3. Bubble check
4. Demonstrate specialized propulsion techniques in varying types of flow
5. Demonstrate proper buoyancy control
6. Demonstrate proper body posture
7. Demonstrate proper stress analysis (detection and management)

In-water skills

1. Properly deploy a guideline
2. Properly use directional and non directional line markers
3. Properly follow a guideline with eyes open and closed (simulating loss of visibility)
4. Air share with a buddy with eyes open , following the guideline
5. Air share with a buddy with lights off and eyes closed and use touch contact, following the guideline
6. Remove and replace mask while in contact with guideline
7. Demonstrate light / hand -signals and touch contact

8. Conservation and awareness techniques
9. Referencing as back-up navigation
10. Demonstrate adequate anti-silting techniques
11. Simulate a primary light failure, and use back light to exit the cave
12. Demonstrate lost line and lost diver drills
13. Demonstrate to use of reels to perform jumps and gaps required in circuits and traverses to maintain a continuous guideline to open water
14. Identify and avoid potential hazard, entanglement and collapse points

In order to complete this course, students must:

1. Satisfactorily complete the TDI Cave Diver Course written examination ***(this requirement may be waived by the instructor if the student is already TDI Full Cave certified)***
2. Perform all land drills and mine dive requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution
4. Maintain an appropriate level of awareness and respect for the mine environment
5. Log all dives

24.12 Permission to Dive

Before conducting training in any man-made environment, permission must be obtained from whoever is responsible for the site; for example the mine owner/operator, government department, etc. Additionally, the relevant local emergency services should be informed of the activity prior to commencement.

25. Rebreather Discovery Program

25.1 Introduction

This program is designed to give prospective students an introduction to diving a TDI approved rebreather in a controlled environment under the direct supervision of an active TDI Rebreather Instructor.

25.2 Qualifications of graduates

This is not a qualification program. Upon successful completion of this program, a certificate may be issued stating that the diver has participated in a rebreather experience.

25.3 Who may teach

1. An active TDI Rebreather Instructor on the unit specific to the conducted program

25.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of the subject matter

Pool

1. A maximum of 2 students per instructor

Confined Water (swimming pool-like conditions)

1. A maximum of 2 per instructor; it is the instructor's discretion to reduce this number as conditions dictate

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 1 student per instructor

25.5 Student Prerequisites

1. Minimum age 18
2. Provide proof of 10 logged open water dives to participate in the pool / confined water session of the program
3. Provide proof of 25 logged open water dives to participate in the open water session of the program
4. TDI Nitrox Diver or equivalent

25.6 Program Structure and Duration

Pool/Confined Water Execution

1. Confined water skills must be completed in water shallow enough to stand up in

2. Minimum of 30 minutes confined water training to a maximum depth of 6 metres / 20 feet if proceeding to the open water portion of the program
3. All confined water sessions must be completed during daylight hours or under conditions that simulate daylight conditions
4. Maximum pool / confined and open water dive time must be completed well within the manufacturer scrubber duration recommendation
5. Instructors are not allowed to carry any photo or video equipment while conducting confined dives (hands free systems are acceptable as long as they require zero input from the instructor during the dive)
6. Instructors must remain close enough to program attendees to lend immediate assistance throughout the entire experience
7. 7. Rebreather should be disinfected based on the manufacturers recommendations as appropriate between users

Open Water Execution

1. An optional open water session to a maximum depth of 9 metres / 30 feet may be conducted
2. Maximum pool / confined and open water dive time must be completed well within the manufacturer scrubber duration recommendation
3. All open water sessions must be completed during daylight hours or under conditions that simulate daylight conditions
4. Instructors are not allowed to carry any photo or video equipment while conducting open water dives (hands free systems are acceptable as long as they require zero input from the instructor during the dive)
5. The open water execution may be repeated within one week of the original program at the instructor's discretion. A dive briefing will replace the academic development. In this instance, key safety drills from the pool / confined water portion must be repeated before each open water dive in water shallow enough to stand up in
6. Instructors must remain close enough to the program attendee to lend immediate assistance throughout the entire experience.

Program Structure

1. TDI allows instructors to structure programs according to the number of students participating and their skill level

Duration

1. The suggested number of training hours is 2

25.7 Administrative requirements

Administrative Tasks:

1. Collect the program fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the schedule to the students
4. Have the students complete prior to training:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the experience program, the Instructor can:

5. At the Instructor's discretion, issue a certificate stating that the diver has participated in a discover rebreather diving experience. This certificate should be produced by the instructor and should indicate this certificate is not a certification to dive a rebreather

25.8 Required equipment

The following equipment is required for each student:

1. A complete TDI approved rebreather completely assembled by an active TDI Rebreather Instructor who holds the rating for the specific unit the student is diving
2. Rebreather build list required by the manufacturer
3. Minimum of 1 CCR dive computer or PO_2 monitoring device
4. Mask and fins
5. Exposure suit appropriate for the environment where training will be conducted
6. Appropriate weight
7. Access to an oxygen analyzer
8. Bailout gas supply (may be the on-board diluent supply)

Note: The Instructor must carry a bailout gas supply for the students. This redundant air source must be greater than the Instructor rebreather requirement if diving a rebreather. The instructor may choose to be on a TDI approved rebreather they hold instructor ratings for or opt to be on open circuit.

25.9 Required subject areas

Instructors may use additional text or materials that they feel help present these topics. The following topics must be covered during the program:

1. Brief Introduction on the History and Evolution of Rebreathers
2. Practical Mechanics of the System
    a. Counter lungs purpose
    b. Scrubber material purpose
    c. Oxygen cylinder
    d. Diluent cylinder
    e. Mouthpiece
    f. Harness and BCD
3. Breathing Gas
    a. Reintroduce the concept of nitrox and its advantages
    b. Introduce the PO_2 concept and Daltons Law
    c. Introduce the PO_2 set points on the rebreather
    d. Oxygen fuel cells, redundancy and voting logic
4. Gas Physiology
    a. Oxygen limitations
    b. Nitrogen limitations
    c. CO_2 limitations, scrubber duration

   d. Gas consumption / limitations
5. Middle ear oxygen absorption syndrome - Equalization necessary after diving
6. Systems Electronics Functionality and Calibration Procedures. Calibration Procedure to be Performed by the Active TDI Rebreather Instructor
7. PO_2 Monitoring
8. Emergency Procedures
   a. Bailing out
   b. Proper weighting / weight check
   c. Descent procedures
      i. Gas additions as appropriate:
         1. Cunter lungs
         2. BCD
         3.
   d. Ascent procedures
      i. Venting gas as appropriate:
         1. Counter lungs
         2. BCD
   e. Explain manual addition and automatic diluent valve addition
   f. Alarms
   g. Three H's: Hypoxia, Hyperoxia, Hypercapnia
   h. Flooded loop

25.10 Required Skill Performance and Graduation Requirements

Students are required to successfully complete the following skills in the pool / confined and open water within the following program limits:

1. All dives to be completed within CNS% limits with a recommended maximum of 80% of the total PO_2 CNS limit.
2. PO_2 not to exceed manufacturer recommendation or 1.3. Minimum PO_2 set point of .7
3. Where an automatic diluent valve (ADV) is fitted by the manufacturer, additional skills such as regular gauge and electronics monitoring and manual control must be emphasized
4. Descent and ascent must be done following a gradual increase such as a beach access with gentle slope or using a descent line/reference to the bottom and surface

Pool / Confined Water Skills:

1. Pre dive checks
2. Leak checks
3. Demonstrate understanding of monitoring PO_2 and CO_2 Sensor (if applicable)
4. Demonstrate understanding of monitoring pressure gauges
5. Demonstrate mouthpiece familiarity; being able to close the mouthpiece properly and bail out to open circuit
6. Descent procedures: adding gas to BCD and counter lungs as appropriate

7. Adding diluent manually (if applicable)
8. Understanding the ADV
9. Swimming and maintaining buoyancy
10. What to do in case of light gurgling
11. Maintaining adequate loop volume
12. Alarms = immediate bailout
13. Ascending in the water while venting air spaces: lungs, counter lungs, BCD

Open Water Skills:

1. PO_2 monitoring
2. Monitoring pressure gauges
3. Maintaining buoyancy
4. Maintaining adequate loop volume

In order to complete the rebreather discovery program the student must:

1. Satisfactorily complete the written examination with a minimum score of 80 percent followed by 100 percent remediation
2. Complete, to the instructors satisfaction, all confined and open water skill development sessions
3. Demonstrate mature, sound judgment concerning dive planning and execution

The following articles and books are recommended reading and allow wider understanding.

1. Richard Pyle - A Learners Guide to Closed Circuit Rebreather Operations
2. Kenneth Donald - Oxygen & the Diver
3. John Lamb - *Oxygen Measurement for Divers*
4. Barsky, Thurlow & Ward - *The Simple Guide to Rebreather Diving*
5. Bob Cole - *Rebreather Diving*
6. Jeffrey Bozanic - *Mastering Rebreathers*

26. Semi-Closed Circuit Rebreather Diver, Unit Specific- DOLPHIN, RAY, Atlantis, SUBMATIX ST100 & AZIMUTH

26.1 Introduction

This is the entry-level certification course for recreational divers wishing to utilize one of the following semi-closed circuit rebreathers: Dolphin, Ray, Submatix ST100 or Azimuth. The objective of this course is to train recreational divers in the benefits, hazards and proper procedures for using SCR rebreathers.

26.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in no decompression diving activities utilizing the Dolphin, Ray, Submatix ST100 or Azimuth to a maximum depth of 40 metres / 130 feet, without decompression; utilizing nitrox mixes not exceeding their level of certification.

26.3 Who May Teach

Any active TDI Rebreather Instructor may teach this course. Specific instructor certification required for each specific rebreather.

26.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 6 students per instructor for the Draeger units, maximum of 4 students per instructor for the Azimuth and Submatix units; it is the instructor's discretion to reduce this number as conditions dictate

26.5 Student Prerequisites

1. Minimum age 18, 15 with parental consent
2. Minimum certification of TDI Nitrox Diver, may be combined in program, or equivalent at the discretion of the instructor

26.6 Course Structure and Duration

Open Water Execution

1. A minimum of 4 dives with a minimum of 100 accumulated minutes for the Drager units
2. A minimum of 5 dives with a minimum of 125 accumulated minutes for the Submatix ST100
3. A minimum of 6 dives with a minimum of 150 accumulated minutes for the Azimuth

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 6

26.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

26.8 Training Material

Required material

1. *TDI Diving Rebreathers* Student Manual
2. Specific manufacturer manual for the rebreather being dived

Optional Material

1. TDI plastic EAD and PO_2 tables
2. *TDI Diving Rebreathers* PowerPoint Presentation
3. Nitrox and rebreather equations software

26.9 Required Equipment

The following equipment is required for each student:

1. Rebreather specific to the training being conducted
2. Integrated PO_2 monitoring device for inhaled PO_2 for each rebreather **(See item 17.13 if unit is equipped)**

3. Mask and fins
4. Exposure suit appropriate for the open water environment
5. Access to oxygen analyzer, instructor may supply
6. Weight / weight system
7. Bailout cylinder, minimum size 1.9 litres / 13 cubic feet
8. Flow meter, instructor may supply

26.10 Required Subject Areas

The *TDI Diving Rebreathers* Student Manual and the manufacturer's manual are mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. History and Evolution of Rebreathers
2. Comparison of Open Circuit, Closed Circuit, and Semi-closed Circuit
3. Practical Mechanics of the System
    a. Assembly and disassembly of the rebreather
    b. Layout and design
    c. Scrubber recharge
    d. System maintenance
    e. Breathing loop decontamination procedures
4. Review of Nitrox
    a. Dalton's Law (triangle)
    b. Optimum nitrox mix
    c. Oxygen tracking
    d. Gas preparation
    e. Dive planning examples
5. Gas Physiology
    a. Oxygen (O_2) toxicity
    b. Hyperoxia
    c. Hypoxia
    d. Asphyxia
    e. Hypercapnia
    f. Nitrogen absorption
    g. Carbon monoxide (CO_2) toxicity
    h. Gas consumption
        i. Cylinder sizes
        ii. Depth and workload
6. Formula Work / Metabolic Consumption
    a. Oxygen (O_2) metabolizing calculations
    b. Inspired oxygen (O_2) calculations (rebreather equation)

   c. Equivalent air depth (EAD)
7. Dive Tables
   a. Inspired oxygen (O_2) table
   b. Equivalent air depth
8. Dive Computers
   a. Mix adjustable
   b. Oxygen (O_2) integrated
   c. PO_2 monitoring devices
9. Problem Solving
   a. Canister flooding
   b. Mouthpiece loss
   c. Scrubber exhaustion
   d. Battery or sensor loss
   e. Breathing bag rupture
   f. Open circuit bailout system
      i. On board gas
      ii. Off board gas
   g. Hyperoxia scenario
   h. Hypoxia scenario
   i. Hypercapnia scenario
   j. Post problem maintenance of equipment
10. Dive Planning
   a. Operational planning
      i. Gas requirements
      ii. Oxygen limitations
      iii. Nitrogen limitations

26.11 Required Skill Performance and Graduation Requirements

The dive depth shall not exceed 1.6 ATM PO_2. The following skills must be completed by the student during open water dives:

1. Properly analyze gas mixture
2. Perform all pre dive checks, positive, negative, flow rate, by-pass regulator operation, relief valve pressure, a minimum of 6 times
3. Demonstrate a leak check and repair scenario
4. Demonstration of integrity of exhale counter-lung for Submatix ST100
5. Properly packing a scrubber canister a minimum of 2 times; if using the ExtendAir cartridge one packing must be with granular material
6. Properly execute set-up and breakdown; a minimum of 6 times for Azimuth or 4 times for Draeger and Submatix ST100 rebreathers
7. Demonstrate adequate pre-dive planning

   a. Limits based on system performance
   b. Limits based upon oxygen exposures at planned depth with mix
   c. Limits based upon nitrogen absorption at planned depth with mix
8. Properly execute the planned dives within all pre-determined limits
9. Properly execute a recovery from a system failure and switch to bail-out stationary a minimum of 2 times
10. Properly execute a recovery from a system failure and switch to bail-out hovering a minimum of 2 times, one of the bail-out scenarios the diver must switch to open circuit and complete dive and safety stop on open circuit; direct ascent must begin when diver switches to open circuit, this scenario should be conducted no deeper than 20 metres / 60 feet
11. Properly demonstrate hose clearing technique after each bail-out scenario
12. Perform block switch a minimum of 2 times, Azimuth only
13. Proper PO_2 monitoring on all dives, if unit is equipped with PO_2 monitoring device
14. Properly execute a mask clearing exercise with emphasis on minimal gas loss
15. Safely and properly execute a buddy out of air scenario, it is preferable the buddy is on a SCR unit also
16. Diver will demonstrate actual safety stops at pre-determined depths
17. Properly execute cleaning and maintenance of the rebreather, including breathing loop decontamination

In order to complete this course, students must:

1. Satisfactorily complete the TDI Diving Rebreathers Course written examination
2. Complete all open water requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution

27. KISS GEM Level 1 Diver

27.1 Introduction

This is the entry-level certification course for recreational divers wishing to utilize the GEM semi-closed circuit rebreather in recreational diving. The objective of this course is to instruct divers in the procedures, benefits and hazards of semi-closed circuit diving using the GEM.

27.2 Qualifications of Graduates

Upon successful completion of this course graduates may engage in no-decompression diving utilizing the GEM semi-closed circuit rebreather with a nitrox mix of between 32% and 40% to a maximum depth of 30 metres / 100 feet with a PO_2 not to exceed 1.4 ATA based on cylinder contents.

27.3 Who May Teach

Any active TDI KISS GEM Level 1 Instructor may teach this course

27.4 Student to Instructor Ratio

Academic:

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. A maximum of 4 students per instructor

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per instructor;, it is the instructor's discretion to reduce this number as conditions dictate

27.5 Student Prerequisites

1. Minimum age of 18
2. Provide proof of:
    a. SDI Nitrox Diver or equivalent at the discretion of the instructor
    b. SDI Advanced Diver or equivalent at the discretion of the instructor

27.6 Course Structure and Duration

Confined Water Execution

1. A minimum of 1 confined water dive with a minimum of 60 minutes of accumulated bottom time

Open Water Execution:

1. A minimum of 5 dives with a minimum of 200 accumulated minutes; two dives must be deeper than 15 metres/50 feet

Course Structure:

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration:

1. The minimum number of classroom and briefing hours is 6; minimum course duration 3 days.

Crossovers:

For divers that have already received training on a TDI approved SCR, they must meet all GEM standards with the exception of the following:

1. Minimum of 3 open water dives for a minimum accumulated bottom time of 120 minutes. The 60 minutes of confined water time is still required

27.7 Administrative Requirements

Administrative Tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

27.8 Training Material

Required material

1. KISS GEM owner's manual
2. TDI KISS GEM PowerPoint Slides

Optional Material

1. TDI plastic EAD and PO_2 tables

27.9 Required Equipment

The following equipment is required for each student:

1. A complete GEM rebreather
2. Printed checklists from the GEM owner's manual

3. GEM rebreather owner's manual
4. A minimum of 1 integrated PO_2 monitoring for each GEM
5. Access to oxygen analyzer (instructor may supply)
6. Adequate CO_2 absorbent (ExtendAir™ cartridge or equivalent) for the dives to be conducted
7. Underwater slate
8. Depth gauge and automatic bottom timer AND/OR nitrox dive computer
9. Mask and fins
10. Exposure suit appropriate for the open water environment
11. Appropriate weight
12. Toolkit with appropriate spares (instructor may supply)
13. Disinfectant (instructor may supply)
14. One line cutting device

27.10 Required Subject Areas

The KISS GEM Owner's Manual and KISS GEM PowerPoint Slides are mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. History and Evolution of Rebreathers
2. Comparison of Open Circuit, Closed Circuit, and Semi-closed Circuit
3. Practical Mechanics of the GEM Rebreather System
    a. Assembly and disassembly of the GEM rebreather
    b. Layout and design
    c. Scrubber replacement
    d. Pre-dive safety check sequence
    e. System maintenance and storage
    f. Breathing loop decontamination procedures
4. Review of Nitrox
    a. Dalton's Law (triangle)
    b. Optimum nitrox mix
    c. Oxygen tracking
    d. Gas preparation and analysis
5. Gas Physiology
    a. Oxygen toxicity
    b. Hyperoxia
    c. Hypoxia
    d. Asphyxia
    e. Hypercapnia
    f. Nitrogen absorption
    g. CO_2 toxicity
    h. Gas consumption

i. Cylinder sizes
ii. Depth and workload

6. Formula work / metabolic consumption
    a. Cylinder size/duration equation
    b. Equivalent air depth
7. Dive Tables
    a. Inspired O_2 table
    b. Equivalent air depth.
8. Dive Computers
    a. Mix adjustable
    b. O_2 integrated
    c. PO_2 monitoring devices
9. Dive Planning
    a. Operational planning
    b. Gas requirements including bailout scenarios
    c. Oxygen limitations
    d. Nitrogen limitations
10. Problem Solving
    a. Canister flooding
    b. Mouthpiece loss
    c. Scrubber exhaustion
    d. Battery or sensor failure
    e. Breathing bag rupture
    f. Open circuit bailout
    g. Hyperoxia scenario
    h. Hypoxia scenario
    i. Hypercapnia scenario
    j. Post problem maintenance of equipment

27.11 Required Skill Performance and Graduation Requirements

The dive depth shall not exceed one point four (1.4 ATM) PO_2. The following skills must be completed by the student during open water dives:

Confined Water Skills:

1. Complete GEM Pre-dive Checklist
2. Pre-dive checks (minimum 1 time)
    a. Scrubber packing
    b. Unit assembly
    c. One-way valve check

   d. Positive and negative pressure tests
3. Properly analyze supply cylinder
4. Proper fitting and adjustment of counter lung system
5. Correct starting orientation of mouth piece
6. Perform in water bubble check
7. Perform 1 stationary bail-out
8. Perform 1 bail-out ascent from a depth not shallower than 1.5 metres/5 feet
9. Perform a complete unit disassembly and cleaning

NOTE: All pool dives must be conducted with a minimum of 40% (+/- 1%) oxygen in the source cylinder

Open Water Skills:

1. Properly analyze gas mixture
2. Perform pre-dive check sequence with use of manufacturer's checklist a minimum of 5 times
3. Demonstrate a leak check and repair scenario
4. Properly pack scrubber canister a minimum of 2 times
5. Properly execute set-up and breakdown a minimum of 5 times
6. Demonstrate adequate pre-dive planning limits based:
   a. On system performance
   b. Upon oxygen exposures at planned depth with mix
   c. Upon nitrogen absorption at planned depth with mix
7. Demonstrate switching to open loop or open circuit when depth is 6 metres/20 feet or shallower
8. Properly execute the planned dives within all pre-determined limits
9. Demonstrate the proper adjustment of the counter-lung system underwater
   a. Adjustment of straps, including removal and replacement
   b. Adjustment of the counter-lung bungees if not previously adjusted
10. Properly execute a recovery from a system failure and switch to bail-out stationary a minimum of 2 times per dive
11. Properly execute a recovery from a system failure and switch to bail-out hovering a minimum of 2 times, one of the bail-out scenarios the diver must switch to open circuit and complete dive and safety stop on open circuit (direct ascent must begin when diver switches to open circuit, this scenario should be conducted no deeper than 18 metres /60 feet
12. Properly demonstrate hose clearing technique after each bail-out scenario
13. Proper PO_2 monitoring on all dives
14. Properly execute a mask clearing exercise with emphasis on minimal gas loss
15. Demonstrate comfort setting up and diving the unit
16. Demonstrate good buoyancy control during the dive
17. Safely and properly execute a buddy out of air scenario, it is preferable the buddy be on an SCR unit also
18. Diver will demonstrate actual safety stops at pre-determined depths
19. Properly execute cleaning and maintenance of the GEM rebreather, including breathing loop decontamination

In order to complete this course, students must:

1. Complete all open water requirements safely and efficiently
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Pass the diver final exam with 80% answered correctly and 100% remediation

28. KISS GEM Sidekick Diver

28.1 Introduction

This is the entry-level certification course for recreational divers wishing to utilize the GEM Sidekick Semi-closed Circuit Rebreather (SCR) in recreational diving. The objective of this course is to instruct divers in the procedures, benefits and hazards of semi-closed circuit diving using the GEM Sidekick.

28.2 Qualifications of Graduates

Upon successful completion of this course graduates may engage in no-decompression diving utilizing the GEM Sidekick SCR with a nitrox mix of between 32% and 40% to a maximum depth of 30 metres / 100 feet with a PO_2 not to exceed 1.4 ATA based on cylinder contents.

28.3 Who May Teach

1. Any active TDI KISS GEM Sidekick Instructor may teach this course

28.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. A maximum of 4 students per instructor

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

28.5 Student Prerequisites

1. Minimum age 18
2. Provide proof of
    a. SDI Advanced Diver or equivalent at the discretion of the instructor
    b. SDI or TDI Nitrox Diver or equivalent, may be combined in the program at the discretion of the instructor

28.6 Course Structure and Duration

Confined Water Execution

1. A minimum of 1 confined water dive with a minimum of 60 minutes of accumulated bottom time

Open Water Execution

1. A minimum of 5 dives with a minimum of 200 accumulated minutes; two dives must be deeper than 15 metres / 50 feet

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level
1. Dives conducted to a maximum depth of 30 metres / 100 feet, not to exceed the maximum depth of the diver's current certification

Duration

1. The minimum number of classroom and briefing hours is 6; minimum course duration 3 days
2. A minimum of 2 hours must be spent on equipment overview and maintenance

Crossovers

1. For divers that have already received training on a KISS GEM with dive experience on the GEM within the past 3 months must meet all GEM Sidekick standards with the exception of the following:
    a. A minimum of 3 hours is required for briefing. This includes going through the PowerPoint specific for the Sidekick, as well as equipment preparation
    b. Minimum of 2 open water dives for a minimum accumulated bottom time of 80 minutes
2. For divers that have already received training on a TDI approved SCR with dive experience on that SCR within the past 3 months must meet all GEM Sidekick standards with the exception of the following:
    a. Minimum of 3 open water dives for a minimum accumulated bottom time of 120 minutes. The 60 minutes of confined water time is still required

28.7 Administrative Requirements

Administrative Tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement f*orm

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

28.8 Training Material

Required material

1. *KISS GEM Sidekick* owner's manual
2. *TDI KISS GEM* PowerPoint Slides
3. *TDI KISS GEM Sidekick* PowerPoint Slides

Optional Material

1. TDI plastic EAD and PO_2 tables

28.9 Required Equipment

The following equipment is required for each student

1. A complete GEM Sidekick SCR
2. Printed checklists from the GEM Sidekick owner's manual
3. GEM Sidekick SCR owner's manual
4. A minimum of 1 integrated PO_2 monitoring for each GEM Sidekick
5. Access to oxygen analyzer (instructor may supply)
6. Adequate CO_2 absorbent (ExtendAir™ cartridge or equivalent) for the dives to be conducted
7. Underwater slate
8. Depth gauge and automatic bottom timer AND/OR nitrox dive computer
9. Mask and fins
10. Exposure suit appropriate for the open water environment
11. Appropriate weight
12. Tool-kit with appropriate spares (instructor may supply)
13. Disinfectant (instructor may supply)
14. One line cutting device

28.10 Required Subject Areas

The KISS GEM Sidekick Owner's Manual and KISS GEM Sidekick PowerPoint Slides are mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. History and Evolution of Rebreathers
2. Comparison of Open Circuit, Closed Circuit, and Semi-closed Circuit
3. Practical Mechanics of the GEM Sidekick SCR System
    a. Assembly and disassembly of the GEM Sidekick SCR
    b. Layout and design
    c. Lung volume control system
    d. Scrubber replacement
    e. Pre-dive safety check sequence
    f. System maintenance and storage
    g. Breathing loop decontamination procedures
4. Review of Nitrox
    a. Dalton's Law (triangle)
    b. Optimum nitrox mix
    c. Oxygen tracking
    d. Gas preparation and analysis

5. Gas Physiology
    a. Oxygen toxicity
    b. Hyperoxia
    c. Hypoxia
    d. Asphyxia
    e. Hypercapnia
    f. Nitrogen absorption
    g. CO_2 toxicity
    h. Gas consumption
    i. Cylinder sizes
    j. Depth and workload
6. Formula work / metabolic consumption
    a. Cylinder size/duration equation
    b. Equivalent air depth
7. Dive Tables
    a. Inspired O_2 table
    b. Equivalent air depth.
8. Dive Computers
    a. Mix adjustable
    b. O_2 integrated
    c. PO_2 monitoring devices
9. Dive Planning
    a. Operational planning
    b. Gas requirements including bailout scenarios
    c. Oxygen limitations
    d. Nitrogen limitations
10. Problem Solving
    a. Canister flooding
    b. Mouthpiece loss
    c. Scrubber exhaustion
    d. Battery or sensor failure
    e. Breathing bag rupture
    f. Open circuit bailout
    g. Hyperoxia scenario
    h. Hypoxia scenario
    i. Hypercapnia scenario
    j. Loop flood recovery
    k. Supply gas disconnect
    l. Post problem maintenance of equipment

28.11 Required Skill Performance and Graduation Requirements

The dive depth shall not exceed one point four (1.4 ATM) PO_2. The following skills must be completed by the student during confined and open water dives

Confined Water Skills

1. Complete GEM Sidekick Pre-dive Checklist
2. Pre-dive checks (minimum 1 time)
    a. Scrubber packing
    b. Unit assembly
    c. One-way valve check
    d. Positive and negative pressure tests
3. Properly analyze supply cylinder
4. Properly calibrate and verify oxygen sensors
5. Proper fitting and adjustment of counter lung system
6. Correct starting orientation of mouthpiece, readjust underwater
7. Perform in water bubble check
8. Demonstrate proper PO_2 monitoring
9. Perform 1 stationary bailout
10. Perform 1 bailout ascent from a depth not shallower than 1.5 metres / 5 feet
11. Lung volume control system adjustment
12. Disconnect and re-connect the gas supply underwater
    Practice breathing in different positions and note the change in the work of breathing in each
13. position
14. Perform a complete unit disassembly and cleaning

NOTE: All pool dives must be conducted with a minimum of 40% (+/- 1%) oxygen in the source cylinder

Open Water Skills

1. Properly analyze gas mixture
2. Properly calibrate and verify oxygen sensors
3. Perform pre-dive check sequence with use of manufacturer's checklist for each dive
4. Demonstrate a leak check and repair scenario
5. Properly pack scrubber canister a minimum of 2 times
6. Properly execute set-up and breakdown for each dive
7. Demonstrate adequate pre-dive planning limits based on:
    a. System performance
    b. Oxygen exposures at planned depth with mix
    c. Nitrogen absorption at planned depth with mix
8. Demonstrate switching to open loop or open circuit when depth is 6 metres / 20 feet or shallower
9. Properly execute the planned dives within all pre-determined limits
10. Demonstrate the proper adjustment of the counter-lung system underwater

11. Lung volume control system adjustment
12. Disconnect and re-connect the gas supply underwater
13. Properly execute a recovery from a system failure and switch to bailout stationary a minimum of 2 times per dive
14. Properly execute a recovery from a system failure and switch to bailout hovering a minimum of 2 times, one of the bailout scenarios the diver must switch to open circuit and complete dive and safety stop on open circuit (direct ascent must begin when diver switches to open circuit, this scenario should be conducted no deeper than 18 metres / 60 feet
15. Properly demonstrate hose clearing technique after each bailout scenario
16. Proper PO_2 monitoring on all dives
17. Properly execute a mask clearing exercise with emphasis on minimal gas loss
18. Demonstrate comfort setting up and diving the unit
19. Demonstrate good buoyancy control and trim during the dive
20. Safely and properly execute a buddy out of air scenario, it is preferable the buddy be on an SCR unit also
21. Diver will demonstrate actual safety stops at pre-determined depths
22. Properly execute partial loop flood recovery procedures a minimum of 2 times
23. Properly execute gas switching procedures a least 3 times
24. Properly execute cleaning and maintenance of the GEM Sidekick SCR, including breathing loop decontamination

In order to complete this course, students must

1. Complete all open water requirements safely and efficiently
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Pass the diver final exam with 80% answered correctly and 100% remediation

29. Air Diluent Closed Circuit Rebreather Diver, Unit Specific

29.1 Introduction

This is the entry level certification course for divers wishing to utilize a closed circuit rebreather (CCR) for air diving. The objective of the course is to train divers in the benefits, hazards and proper procedures for diving a CCR and to develop basic CCR diving skills to a maximum depth of 30 metres / 100 feet, using air as a diluent. No decompression diving is allowed on this course

29.2 Qualifications of Graduates

Upon successful completion of this course, graduates may:

1. Engage in diving activities utilizing the CCR to a maximum depth of 30 metres / 100 feet, utilizing air as a diluent

29.3 Who May Teach

An active TDI Instructor with a TDI Air Diluent CCR Instructor rating on the specific unit being used

29.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. A maximum of 4 students per active TDI Instructor

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per active TDI Instructor
2. The ratio should be reduced as required due to environmental or operational constraints

Special note; A certified assistant is a SDI and or TDI Divemaster or equivalent from agencies recognized by TDI, with an air diluent CCR user qualification and a minimum of 30 hours logged diving on the CCR being taught

29.5 Student Prerequisites

1. Minimum age 18
2. Provide proof of 20 logged open water dives
3. Provide proof as a TDI Nitrox Diver or equivalent from agencies recognized by TDI*
4. If the rebreather is a TDI approved sidemount rebreather, the student must hold the TDI Sidemount Diver certification or equivalent and provide proof of 10 logged sidemount dives.

Note: Nitrox diver may be combined with this course

29.6 Course Structure and Duration

Confined Water Execution:

1. Minimum of 60 minutes confined water training to a maximum of 9 metres / 30 feet

Open Water Execution

1. Minimum of 420 minutes open water training to be completed over a minimum of 7 dives with a gradual increase in depth each day to a maximum of 30 metres / 100 feet

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level
2. The final exam may be given orally if not available in a language the student understands

Duration

1. Minimum of 6 hours academic development and 2 hours equipment maintenance workshop
2. The duration of the entire course must take a minimum of 5 days

Crossover: If a student already is qualified as TDI Air Diluent CCR Diver or equivalent from agencies recognized by TDI wishes to qualify on another CCR recognized by TDI, the student must follow all unit specific course standards with the exception of:

1. Minimum of 60 minutes confined water training to a maximum of 9 metres / 30 feet
2. Minimum of 180 minutes open water training to be completed over a minimum of 3 dives to a maximum depth of 30 metres / 100 feet

29.7 Administrative Requirements

Administrative Tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

29.8 Training Materials

The following are required for this course:

1. *TDI Diving Rebreathers* Student Manual

2. *TDI Diving Rebreathers* PowerPoint Presentation
3. Manufacturer's manual and updates
4. Manufacturer's Build Checklist
5. *TDI CCR Preflight Checklist*
6. Rebreather course evaluation form (see appendix)
7. Mel Clark- *Rebreathers Simplified* (Required for JJ-CCR only)

Optional

1. Mel Clark- *Rebreathers Simplified*

29.9 Required Equipment

The following equipment is required for each student:

1. A complete closed circuit rebreather
2. Minimum of 1 CCR dive computer, or bottom timer and depth gauge
3. Mask, fins and a suitable line-cutting device
4. Slate and pencil
5. Reel with a minimum of 40 metres / 130 feet of line
6. Lift-bag / delayed surface marker buoy (DSMB) with a minimum of 12 kg / 25 lbs lift
7. Exposure suit appropriate for the open water environment where training will be conducted
8. Access to an oxygen analyzer
9. Appropriate weight
10. Bailout gas supply (and an externally carried redundant air source).

Note: The instructor and any certified assistant must also carry a bailout gas supply for the student(s) during all open water sessions. This redundant gas source must be greater than the instructor and any certified assistant's rebreather requirement

29.10 Required Subject Areas

The *TDI Diving Rebreathers* Student Manual and the manufacturer's manual are mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during the course:

1. History and Evolution of Rebreathers
2. Comparison of Open Circuit, Closed Circuit and Semi Closed Circuit Rebreather Systems and the Benefits/Problems with Each
3. Practical Mechanics of the System
    a. Assembly and disassembly of the CCR
    b. Layout and design of the unit
    c. Absorbent canister design and maintenance
    d. Breathing loop de-contamination procedures
    e. Manufacturer supported additional items; automatic diluent valve, etc)

4. Gas Physiology
    a. Oxygen (O_2) toxicity
    b. Nitrogen absorption
    c. Carbon dioxide (CO_2) toxicity
5. Proper Scrubber Packing; in accordance with manufacturer's recommendation
    a. Gas consumption
6. Electronic or Manual Systems Design and Maintenance
    a. Oxygen (O_2) metabolizing calculations
    b. Fuel cells
    c. System electronics functionality and calibration procedures
7. Dive Tables
    a. Constant partial pressure of oxygen (PPO_2) theory
    b. Central nervous system (CNS) and awareness of oxygen tracking units (OTU) tracking
8. Dive Computers
    a. Mix adjustable
    b. Constant PO_2
    c. Oxygen (O_2) integrated
9. Dive Planning
    a. Operational planning
    b. Gas requirements including bailout scenarios
    c. Oxygen limitations
    d. Nitrogen limitations
10. Emergency Procedures
    a. Use of B.A.D.D.A.S.S
    b. Three H's problems
    c. Flooded loop
    d. Cell warnings
    e. Battery warnings

29.11 Required Skill Performance and Graduation Requirements

All standards set by both TDI and the rebreather manufacturer must be met, while maximum limits of neither may be exceeded.

The following open water skills must be completed by the student during open-water dives with the following course limits:

1. All open water dives must be between 9 metres / 30 feet and 30 metres / 100 feet
2. Two dives must be deeper than 20 metres / 60 feet and one dive must be deeper than 27 metres / 90 feet
3. PO_2 not to exceed manufacturer recommendation or a working limit of 1.3 bar
4. All dives to be completed within CNS percentage limits with a recommend maximum of 80 percent of the total PO_2 CNS limit
5. Safety stops to be conducted with a minimum 3 minutes at 6 metres / 20 feet

6. Where the user opts for an automatic diluent valve (ADV) fitted by the manufacturer additional skills such as regular diluent gauge monitoring and addition control must be emphasized

Open Water Skills:

1. Pre dive checks
    a. Unit buildup
    b. Scrubber canister check
    c. Breathing loop check
    d. Positive and negative check
2. Verify diluent and oxygen (O_2) cylinder contents using O_2 analyzer where appropriate
3. Demonstrate correct pre dive planning procedures including
    a. Limits based on system performance
    b. Limits based on oxygen exposures at chosen PPO_2 levels
    c. Limits based on nitrogen absorption at planned depth and PO_2 setpoint
    d. Thermal constraints
4. Emergency procedures
    a. Mouthpiece familiarity drills
    b. Gas shutdowns and loss of gas
    c. Broken hoses
    d. Flooded absorbent canister
    e. Carbon dioxide (CO_2) breakthrough
    f. Low oxygen drills
    g. High oxygen drills
    h. Flooding loop
    i. Electronics and battery failure
    j. Properly execute the ascent procedures for an incapacitated CCR diver
5. Use of BCD/suit and effective management of loop breathing volume for buoyancy control
6. Stop at 3-6 metres / 10 – 20 feet on descent for leak bubble check
7. Electronics systems monitoring for PO_2 levels (SETPOINT) and switching setpoints
8. Manual control of setpoint if electronically controlled CCR is not used
9. Use of lift bag / delayed surface marker buoy and reel (where relevant and applicable)
10. Proper execution of the dive within all pre-determined dive limits
11. Demonstration of safety stops at pre-determined depths
12. Constant loop volume management
13. Post dive clean of unit
    a. Mouth piece and hoses
    b. Clean and disinfect unit
    c. Inspect components of unit
14. Diver maintenance of unit
    a. Cell remove and replace
    b. Mouthpiece strip and rebuild

c. Replacing batteries

In order to complete the course and achieve the TDI Air Diluent CCR rating the student must:

1. Satisfactorily complete the written examination with a minimum score of 80 percent
2. Complete to the instructors satisfaction, all confined and open water skill development sessions
3. Demonstrate mature, sound judgment concerning dive planning and execution
4. Course must be completed within 6 weeks from the starting date
5. Complete a refresher course following a period of inactivity greater than 6 months following the course

The following articles and books are recommended reading and allow wider understanding.

1. Richard Pyle - *A Learners Guide to Closed Circuit Rebreather Operations*
2. Kenneth Donald - *Oxygen & the Diver*
3. John Lamb - *Oxygen Measurement for Divers*
4. Barsky, Thurlow & Ward - *The Simple Guide to Rebreather Diving*
5. Bob Cole - *Rebreather Diving*
6. Jeffrey Bozanic - *Mastering Rebreathers*

30. Air Diluent Closed Circuit Rebreather Decompression Procedures Diver, Unit Specific-

30.1 Introduction

This is the second level certification course for divers wishing to utilize a closed circuit rebreather (CCR) for air diving. The objective of the course is to train divers in the benefits, hazards and proper procedures for diving a CCR and to develop basic CCR diving skills to a maximum depth of 45 metres / 150 feet using an air diluent for formal decompression diving.

30.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in decompression diving activities utilizing a CCR without direct supervision provided:

1. The diving activities approximate those of training
2. The areas of activities approximate those of training
3. Environmental conditions approximate those of training

Upon successful completion of this course, graduates are qualified to enroll in:

1. TDI Mixed Gas CCR unit specific course
2. TDI Advanced Wreck Course

30.3 Who May Teach

An active TDI Instructor with a TDI Air Diluent CCR Decompression Procedures Instructor rating for the specific unit being used.

30.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. A maximum of 4 students per active TDI Instructor is allowed

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per active TDI Instructor is allowed
2. The ratio should be reduced as required due to environmental or operational constraints

30.5 Student Prerequisites

1. Minimum age 18

2. Provide proof of 50 logged dives
3. Provide proof of TDI Advanced Nitrox Diver and Deco Procedures Diver or equivalent from agencies recognized by TDI
4. If the rebreather is a TDI approved sidemount rebreather, the student must hold the TDI Sidemount Diver certification or equivalent and provide proof of 10 logged sidemount dives.

OR

1. Minimum age 18
2. TDI Air Diluent CCR Diver certified or equivalent
3. 30 hours on the CCR unit
4. Six months CCR diving experience

30.6 Course Structure and Duration

Confined Water Execution

1. Minimum of 60 minutes confined water training to a maximum of 9 metres / 30 feet

Open Water Execution

1. Minimum of 420 minutes open water training, to be completed over a minimum of 7 dives with a gradual increase in depth each day to a maximum of 45 metres / 150 feet

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level
2. The final exam may be given orally if not available in a language the student understands

Duration

1. Minimum of 6 hours academic development and 2 hours equipment maintenance workshop
2. The duration of the entire course must take a minimum of 5 days

Crossover

1. If a student already qualified as TDI CCR Air Diluent Deco Diver or equivalent from an agency recognized by TDI and wishes to qualify on another CCR recognized by TDI, the student must follow all unit specific course standards with the exception of:
    a. Minimum of 60 minutes confined water training to a maximum of 9 metres / 30 feet
    b. Minimum of 180 minutes open water training to be completed over a minimum of 3 dives to a maximum of 45 metres / 150 feet

Upgrades

1. If a student has the entry level 1 certification and wishes to do the decompression part of this course, only 240 minutes in open water is required
2. The student must have a minimum of 30 logged hours over 30 dives before enrolment on the deco course
3. Six months CCR diving experience

30.7 Administrative Requirements

Administrative Tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

30.8 Training Materials

Required materials:

1. *TDI Diving Rebreathers* Student Manual
2. Manufacturer's manual and updates
3. *TDI Decompression Procedures* Student Manual
4. *TDI Advanced Nitrox* Student Manual
5. Manufacturer's Build Checklist
6. *TDI CCR Preflight Checklist*
7. Rebreather course evaluation form (see appendix)
8. Mel Clark- *Rebreathers Simplified* (required for JJ-CCR only)

Optional:

1. *TDI Diving Rebreathers* PowerPoint Presentation
2. Mel Clark- *Rebreathers Simplified*
3. Skills prompt slates

30.9 Required Equipment

The following equipment is required:

1. A complete closed circuit rebreather
2. Minimum of 1 CCR dive computer, or bottom timer and depth gauge
3. Mask, fins and a suitable line-cutting device
4. Slate and pencil
5. Reel with a minimum of 50 metres / 165 feet of line
6. Lift bag / delayed surface marker buoy (DSMB) with a minimum of 12 kg / 25 lb lift
7. Exposure suit appropriate for the open water environment where training will be conducted
8. Access to an oxygen analyzer

9. Appropriate weight
10. Bailout gas supply cylinder with a minimum capacity of 5.7 litres / 40 cu ft air or nitrox may be used

Note: The instructor and any certified assistant will also carry a bailout gas supply during all open water sessions. This redundant gas source must be greater than the instructor and any certified assistant's bailout requirements.

30.10 Required Subject Areas

The *TDI Diving Rebreathers* Student Manual and the manufacturer's manual are mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during the course.

1. History and Evolution of Rebreathers
2. Comparison of Open Circuit, Closed Circuit and Semi Closed Circuit Rebreather Systems and the Benefits/Problems with Each
3. Practical Mechanics of the System
    a. Assembly and disassembly of the unit
    b. Layout and design of the unit
    c. Absorbent canister design and maintenance
    d. Proper packing of canister, in accordance with manufacturer's recommendations
    e. Breathing loop de-contamination procedures
    f. Manufacturer supported additional items (Automatic Diluent Valve, etc)
4. Gas Physiology
    a. Oxygen (O_2) toxicity
    b. Nitrogen absorption
    c. Carbon dioxide (CO_2) toxicity
    d. Gas consumption
5. Electronic and Manual Systems Design and Maintenance
    a. Oxygen (O_2) metabolizing calculations
    b. Fuel cells
        i. Maintenance
        ii. Replacement
        iii. Manufacturing date
    c. System electronics functionality and calibration procedures
6. Dive Tables
    a. Constant partial pressure of oxygen (PPO_2) theory
    b. Central nervous system (CNS) and awareness of oxygen tracking units (OTU)
7. Dive Computers
    a. Mix adjustable
    b. Constant percentage of oxygen (PO_2)
    c. Oxygen (O_2) integrated

8. Dive Planning
    a. Operational planning
    b. Gas requirements including bailout scenarios
    c. Oxygen limitations
    d. Nitrogen limitations
9. Emergency Procedures
    a. Use of B.A.D.D.A.S.S
    b. Three H's problems
    c. Flooded loop
    d. Cell warnings
    e. Battery warnings
    f. Bailout gas requirements

30.11 Required Skill Performance and Graduation Requirements

All standards set by both TDI and the rebreather manufacturer must be met, while maximum limits of neither may be exceeded.

The following open water skills must be completed by the student during open water dives with the following course limits:

1. All open water dives must be between 9 metres / 30 feet to 45 metres / 150 feet
2. Two dives must be deeper than 20 metres / 66 feet and one dive must be deeper than 30metres / 100 feet
3. PO_2 not to exceed manufacturer's recommendation or a working limit of 1.3 bar
4. All dives to be completed within CNS percent limits with a recommend maximum of 80 percent of the total PO_2 CNS limit
5. Safety stops to be conducted with a minimum 3 minutes at 6 metres / 20 feet
6. When the user opts for an automatic diluent valve (ADV) fitted by the manufacturer, additional skills such as regular diluent gauge monitoring and addition control must be emphasized
7. Calculate all off board gas at 45.30 litres / 1.6 cubic feet per minute usage to cover stress situations
8. All dives to be completed within appropriate constant PO_2 decompression tables
9. Student is only certified for decompression diving on the specific CCR unit
10. Students must do one bailout from depth on open circuit to include simulated decompression

Open Water Skills:

1. Pre dive checks
    a. Unit build-up
    b. Scrubber packing
    c. Positive and negative checks
2. Verify diluent and O_2 cylinder contents using O_2 analyzer where appropriate
3. Demonstrate correct pre dive planning procedures including
    a. Limits based on system performance
    b. Limits based on oxygen exposures at chosen PPO_2 levels
    c. Limits based on nitrogen absorption at planned depth and PO_2 setpoint

   d. Thermal constraints
4. Emergency procedures
   a. Mouthpiece familiarity drills
   b. Gas shutdowns and loss of gas
   c. Broken hoses
   d. Flooded absorbent canister
   e. Carbon dioxide (CO_2) breakthrough
   f. Semi-closed mode
   g. Low oxygen drills
   h. High oxygen drills
   i. Flooding loop
   j. Electronics and battery failure
   k. Properly execute the ascent procedures for an incapacitated CCR diver
5. Use of BCD/suit and effective management of loop breathing volume for buoyancy control
6. Stop at 3-6 metres / 10 – 20 feet on descent for leak bubble check
7. Electronics systems monitoring for PO_2 levels (SETPOINT) and switching setpoints
8. Manual control of setpoint if electronically controlled CCR is not used
9. Use of lift bag / delayed surface marker buoy and reel
10. Proper execution of the dive within all pre-determined dive limits
    a. Constant loop volume management
11. Post dive clean of unit to avoid contamination and spread of disease

If this is the first CCR course taken the following must be included:

1. Post dive clean of unit
   a. Mouth piece and hoses
   b. Clean and disinfect unit
   c. Inspect components of unit
2. Dive maintenance of unit
   a. Cell remove and replace
   b. Mouth piece strip and rebuild
   c. Replacing batteries

Decompression related in water skills:

1. Demonstrate comfort swimming on surface and at depth carrying 1 bailout/decompression cylinder
2. Demonstrate ability to drop and retrieve 1 bailout/decompression cylinder while maintaining position in the water column
3. Demonstrate ability to deploy SMB or lift-bag solo and as a member of a team
4. Demonstrate appropriate reaction to gas hemorrhage from manifold or first stage, SPG and primary regulator
5. Demonstrate appropriate reaction to simulated free-flowing deco regulator
6. Buddy breathing deco gas for at least 1 minute
7. Oxygen rebreather mode at less than 6 metres / 20 foot stop

8. Complete 1 bailout scenario at depth to include decompression obligation on open circuit

In order to complete the course and achieve the TDI Air Diluent Decompression Procedures CCR rating the student must:

1. Satisfactorily complete the written examination with a minimum score of 80 percent and 100% remediation
2. Complete to the instructor's satisfaction all confined and open water skill development sessions
3. Demonstrate mature, sound judgment concerning dive planning and execution
4. Course must be completed within 6 weeks from the starting date
5. Complete a refresher course following a period of inactivity greater than 6 months following the course

Recommended Additional Reading and Support Material

1. Richard Pyle - *A Learners Guide to Closed Circuit Rebreather Operations*
2. Kenneth Donald - *Oxygen & The Diver*
3. John Lamb - *Oxygen Measurement for Divers*
4. Barsky, Thurlow & Ward - *The Simple Guide to Rebreather Diving*
5. Bob Cole - *Rebreather Diving*
6. Jeffrey Bozanic - *Mastering Rebreathers*

31. Helitrox Diluent Closed Circuit Rebreather Diver Decompression Procedures Course, Unit Specific-

31.1 Introduction

This is the second entry level certification course for divers wishing to utilize a closed circuit rebreather (CCR) for mixed gas diving using a Helitrox diluent. The objective of the course is to train divers in the benefits, hazards and proper procedures for diving a CCR and to develop basic CCR diving skills, to a maximum of 45 metres / 150 feet, using an air/nitrox/helium diluent for formal decompression diving. Student are permitted to utilize a diluent and bailout mix with no greater than a 20% helium content and no less than a 21% oxygen content and are permitted to use up to 100% oxygen for decompression.

31.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in decompression diving activities utilizing a CCR without direct supervision provided

1. The diving activities approximate those of training
2. The areas of activities approximate those of training
3. Environmental conditions approximate those of training

Upon successful completion of this course, graduates are qualified to enroll in:

4. TDI Mixed Gas CCR unit specific course
5. TDI Advanced Wreck Course

31.3 Who May Teach

1. An active TDI Instructor with a TDI Helitrox Diluent CCR Decompression Procedures Instructor rating for the specific unit being used.

Aside from doing a TDI Helitrox Diluent Decompression Procedures Instructor Course with a suitably qualified Instructor Trainer current TDI Instructors who meet the following requirements may apply to Headquarters for approval to teach this program:

1. Be a current TDI Air Diluent CCR Decompression Procedures Instructor on the specific unit being used
2. Be a current TDI Trimix Instructor
3. Be a current TDI CCR Mixed Gas Diver on the unit being used
4. Have properly verified proof of 15 logged mixed gas dives on a rebreather, 5 of which must be on the specific unit being taught, with 5 logged dives beyond 30 metres / 100 feet

31.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. A maximum of 4 students per active TDI Instructor is allowed

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per active TDI Instructor is allowed
2. The ratio should be reduced as required due to environmental or operational constraints

31.5 Student Prerequisites

1. Minimum age 18
2. Provide proof of 50 logged dives
3. Minimum certification level of TDI Advanced Nitrox Diver, Deco Procedures Diver or Helitrox diver or equivalent from agencies recognized by TDI
4. If the rebreather is a TDI approved sidemount rebreather, the student must hold the TDI Sidemount Diver certification or equivalent and provide proof of 10 logged sidemount dives.

OR

1. Minimum age 18
2. TDI Air Diluent CCR Diver certified or equivalent
3. 30 hours on the CCR unit
4. Six months CCR diving experience

31.6 Course Structure and Duration

Confined Water Execution

1. Minimum of 60 minutes confined water training to a maximum of 9 metres / 30 feet

Open Water Execution

1. Minimum of 420 minutes open water training to be completed over a minimum of 7 dives with a gradual increase in depth each day to a maximum of 45 metres / 150 feet

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level
2. The final exam may be given orally if not available in a language the student understands

Duration

1. Minimum of 6 hours academic development and 2 hours equipment maintenance workshop
2. The duration of the entire course must be spread over a minimum of 5 days

Crossover

3. If a student already qualified as TDI Helitrox Diluent Deco Procedures CCR Diver or equivalent from agencies recognized by TDI and wishes to qualify on another CCR recognized by TDI, the student must follow all unit specific course standards with the exception of:
    a. Minimum of 60 minutes confined water training to a maximum of 9 metres / 30 feet

b. Minimum of 180 minutes open water training to be completed over a minimum of 3 dives to a maximum of 45 metres / 150 feet

Upgrades

1. If a student has the entry level 1 certification and wishes to do the Helitrox decompression part of this course, only 240 minutes open water are required
2. The student needs to have a minimum of 30 logged hours over 30 dives before enrolment on the Helitrox deco course
3. Six months CCR diving experience
4. If a student has the TDI Air Diluent Decompression certification and wishes to do the Helitrox decompression part of this course, only 120 minutes open water are required

31.7 Administrative Requirements

Administrative Tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the Instructor must:

1. Issue the appropriate TDI certification by submitting the *TDI Diver Registration* Form to TDI Headquarters or registering the student online through the member's area of the TDI website

31.8 Training Materials

Required Materials

1. *TDI Diving Rebreathers* Student Manual or TDI Generic CCR On-line Course
2. Manufacturer's manual and updates
3. Manufacturer's Build Checklist
4. *TDI CCR Preflight Checklist*
5. *TDI Decompression Procedures* Student Manual
6. *TDI Extended Range and Trimix Diver* Student Manual
7. *TDI Advanced Nitrox* Student Manual or *TDI Advanced Nitrox* On-line Course
8. Rebreather Course Evaluation Form (see appendix)
9. Mel Clark- *Rebreathers Simplified* (required for JJ-CCR only)
10.

Optional

1. *TDI Diving Rebreathers* PowerPoint Presentation
2. Mel Clark- *Rebreathers Simplified*

3. Skills prompt slates

31.9 Required Equipment

The following equipment is required:

1. A complete closed circuit rebreather
2. Minimum of 1 CCR dive computer and / or bottom timer and depth gauge
3. Mask, fins and a suitable line-cutting device
4. Slate and pencil
5. Reel with a minimum of 50 metres / 165 feet of line
6. Lift Bag / Delayed Surface Marker Buoy (DSMB) with a minimum of 12 kg / 25 lb lift
7. Exposure suit appropriate for the open water environment where training will be conducted
8. Access to an oxygen/helium analyzer
9. Appropriate weight
10. Bailout gas supply cylinder with a minimum capacity of 5 litres / 40 cu ft air or nitrox may be used

Note: The instructor and any certified assistant will also carry a bailout gas supply during all open water sessions. This redundant gas source must be greater than the instructor and any certified assistant's bailout requirements.

31.10 Required Subject Areas

The *TDI Diving Rebreathers* Student Manual and the manufacturer's manual are mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during the course.

1. History and Evolution of Rebreathers
2. Comparison of Open Circuit, Closed Circuit and Semi Closed Circuit Rebreather Systems and the Benefits/Problems with Each
3. Practical Mechanics of the System
    a. Assembly and disassembly of the unit
    b. Layout and design of the unit
    c. Absorbent canister design and maintenance
    d. Proper packing of canister, in accordance with manufactures recommendations
    e. Breathing loop de-contamination procedures
    f. Manufacturer supported additional items (automatic diluent valve, etc.)
4. Gas Physiology
    a. Oxygen toxicity
    b. Nitrogen absorption
    c. CO_2 toxicity
    d. Gas consumption
5. Electronic and Manual Systems Design and Maintenance
    a. O_2 metabolizing calculations

   b. Fuel cells
      i. Maintenance
      ii. Replacement
      iii. Manufacturing date
   c. System electronics functionality and calibration procedures
6. Dive Tables
   a. Constant partial pressure of oxygen (PPO_2) theory
   b. Central nervous system (CNS) and awareness of oxygen tracking units (OTU)
7. Dive Computers
   a. Mix ajustable
   b. Constant PO_2
   c. O_2 integrated
8. Dive Planning
   a. Operational planning
   b. Gas requirements including bailout scenarios
   c. Oxygen limitations
   d. Nitrogen limitations
9. Emergency Procedures
   a. Use of B.A.D.D.A.S.S.
   b. Three H's problems
   c. Flooded loop
   d. Cell warnings
   e. Battery warnings
   f. Bailout gas requirements
10. Helium Considerations
   a. Helium absorption and elimination
   b. Advantages of hyperoxic mixes for decompression
   c. Advantages of helium for bottom gas
   d. Hypoxia
   e. HPNS
   f. Effects on respiration
   g. Effects as an insulator
   h. Helium limitations

31.11 Required Skill Performance and Graduation Requirements

All standards set by both TDI and the rebreather manufacturer must be met, while maximum limits of neither may be exceeded.

The following open water skills must be completed by the student during open-water dives with the following course limits:

1. All open water dives must be between 9 metres / 30 feet to 45 meters / 150 feet

2. Two dives must be deeper than 20 metres / 66 feet and one dive must be deeper than 30 metres / 100 feet
3. PO_2 not to exceed manufacturer recommendation or a working limit of 1.3 bar
4. All dives to be completed within CNS% limits with a recommend maximum of 80% of the total PO_2 CNS limit
5. Safety stops to be conducted with a minimum 3 minutes at 6 metres / 20 feet
6. Where the user opts for an automatic diluent valve (ADV) fitted by the manufacturer additional skills such as regular diluent gauge monitoring and addition control must be emphasized
7. Calculate all off board gas at 45.3 litres / 1.6 cubic feet per minute usage to cover stress situations
8. All dives to be completed within appropriate constant PO_2 decompression tables
9. Student is only certified for Helitrox decompression diving on the specific CCR unit
10. Students must do one bailout from depth on o/c to include simulated decompression

Open Water Skills:

1. Pre dive checks
    a. Unit build-up
    b. Scrubber packing
    c. Positive and negative checks
2. Verify diluent and O_2 cylinder contents using O2 analyzer where appropriate
3. Demonstrate correct pre dive planning procedures including
    a. Limits based on system performance
    b. Limits based on oxygen exposures at chosen PPO_2 levels
    c. Limits based on nitrogen absorption at planned depth and PO_2 set-point
    d. Thermal constraints
4. Emergency procedures
    a. Mouthpiece familiarity drills
    b. Gas shutdowns and loss of gas
    c. Broken hoses
    d. Flooded absorbent canister
    e. CO_2 breakthrough
    f. Semi-closed mode
    g. Low oxygen drills
    h. High oxygen drills
    i. Flooding Loop
    j. Electronics and battery failure
    k. Properly execute the ascent procedures for an incapacitated CCR diver
5. Use of BCD/suit and effective management of loop breathing volume for buoyancy control
6. Stop at 3-6 metres / 10 – 20 feet on descent for leak bubble check
7. Electronics systems monitoring for PO_2 levels (SETPOINT) and switching set-points
8. Manual control of set-point if electronically controlled CCR is not used
9. Use of lift-bag / delayed surface marker buoy and reel

10. Proper execution of the dive within all pre-determined dive limits
    a. Constant-loop volume management
11. Post dive clean of unit to avoid contamination and spread of disease

If this is the first CCR course taken the following must be included

1. Post dive clean of unit
    a. Mouth piece and hoses
    b. Clean and disinfect unit
    c. Inspect components of unit
2. Dive maintenance of unit
    a. Cell remove and replace
    b. Mouth piece strip and rebuild
    c. Replacing batteries

Decompression related in water skills

1. Demonstrate comfort swimming on surface and at depth carrying 1bailout/decompression cylinder
2. Demonstrate ability to drop and retrieve one bailout/decompression cylinder while maintaining position in the water column
3. Demonstrate ability to deploy SMB or lift-bag solo and as a member of a team
4. Demonstrate appropriate reaction to gas hemorrhage from manifold or first stage, SPG and primary regulator
5. Demonstrate appropriate reaction to simulated free-flowing deco regulator
6. Buddy breathing deco gas for at least 1 minute
7. Oxygen rebreather mode at less than 6 metres / 20 foot stop
8. Complete 1 bailout scenario at depth to include decompression obligation on open circuit

In order to complete the course and achieve the TDI Helitrox Diluent Decompression Procedures CCR rating the student must:

1. Satisfactorily complete the written examination with a pass mark of 80% and 100% remediation
2. Complete to the instructor's satisfaction all confined and open water skill development sessions
3. Demonstrate mature, sound judgment concerning dive planning and execution
4. Course must be completed within 6 weeks from the starting date
5. Complete a refresher course following a period of inactivity greater than 6 months following the course

Recommended Additional Reading and Support Material

1. Richard Pyle - A Learners Guide to Closed Circuit Rebreather Operations
2. Kenneth Donald - *Oxygen & The Diver*
3. John Lamb - *Oxygen Measurement for Divers*
4. Barsky, Thurlow & Ward - *The Simple Guide to Rebreather Diving*
5. Bob Cole - *Rebreather Diving*
6. Jeffrey Bozanic - *Mastering Rebreathers*

32. Mixed Gas Closed Circuit Rebreather Diver, Unit Specific

*** Discovery MK VI / SE7EN / Se7en must be equipped with full 60 M upgrades, including 60M-emodule and counterlungs with manual addition valves**.

32.1 Introduction

This is the intermediate level certification course for divers wishing to utilize a closed circuit rebreather (CCR) for mixed gas diving. The objective of the course is to train divers in the benefits, hazards and proper procedures for mixed gas diving on the unit specific CCR, utilizing a mixed gas diluent containing 16 percent or greater oxygen, and to develop intermediate CCR diving skills appropriate to technical diving to a maximum depth of 60 metres / 200 feet.

32.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in technical diving activities utilizing the unit specific CCR to a maximum of 60 metres / 200 feet, utilizing a mixed gas diluent containing 16 percent or greater oxygen provided:

1. The diving activities approximate those of training
2. The areas of activities approximate those of training
3. Environmental conditions approximate those of training

Upon successful completion of this course, graduates are qualified to enroll in:

1. TDI Advanced Mixed Gas Closed Circuit Rebreather Diver, unit specific.

32.3 Who May Teach

An active TDI Closed Circuit Rebreather Instructor, with a unit specific TDI Mixed Gas Instructor rating.

32.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. A maximum of 3 students per active TDI Instructor is allowed or 4 with a certified assistant

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 3 students per active TDI Instructor is allowed or 4 with a certified assistant
2. The ratio should be reduced as appropriate due to environmental or operational constraints

Special note; A certified assistant is a TDI Divemaster or equivalent from agencies recognized by TDI, with a mixed gas CCR user qualification and a minimum of 50 hours logged diving on the CCR being taught.

32.5 Student Prerequisites

1. Minimum age 18
2. Provide a verified log of a minimum of 50 rebreather hours distributed over a minimum of 50 dives on the specific rebreather. Valid logged dives must be deeper than 9 metres / 20 feet, half of which must be deeper than 20 metres / 66 feet. If the diver has 50 hours on another CCR unit recognized by TDI, only 25 hours are required to be on the specific unit
3. Have completed and qualified the TDI Air Diluent Decompression Procedures Rebreather/TDI CCR Helitrox Diluent Decompression Procedures Diver course or equivalent from agencies recognized by TDI

32.6 Course Structure and Duration

Open Water Execution

1. Minimum of 360 minutes open water training to be completed over a minimum of 6 dives including 1 equipment configuration and drills practice air diluent dive to a maximum 40 metres / 130 feet
2. All subsequent dives to build incrementally in no greater than 10 metres / 33 feet steps
3. A minimum of 5 dives must be conducted on mixed gas diluent.
4. All mixed gas dives are to be deeper than 40 metres / 130 feet, utilizing a mixed gas diluent containing 16 percent or greater oxygen, to a maximum depth of 60 metres/200 feet
5. A minimum of four dives must be decompression dives

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level
2. Oral examinations are permitted if the exam is not available in a language the student understands

Duration

1. Minimum of 6 hours for academic development and a further 2 hours for equipment configuration workshop

Special note: If the diver is already open circuit trimix certified; 6 dives and 360 minutes are still required.

32.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters/Regional Office or registering the students online through member's area of the TDI website

32.8 Required Equipment

The following are required for this course:

1. TDI Diving Rebreathers Student Manual
2. *TDI CCR Preflight Checklist*
3. *TDI Diving Rebreathers* PowerPoint Presentation
4. Unit specific rebreather manual
5. Unit specific rebreather examination if required by the manufacturer
6. Manufacturer's Build Checklist
7. Manufacturer's manual and updates

The following equipment is required for each student:

1. A complete closed circuit rebreather configured within the manufacturers recommendations; this should be the student's personal unit
2. Minimum of 2 bottom timers and depth gauges or; 1 CCR mixed gas computer and 1 bottom timer and depth gauge
3. Bailout gas supply in a minimum of 2 separate off-board cylinders; calculated at 45.30 litres /1.06 cubic feet per minute usage to cover stress situations
4. Two open circuit regulators and gauges fitted to the configuration
5. Mask, fins and a suitable line-cutting device
6. Slate and pencil
7. Reel with a minimum of 60 metres / 200 feet of line
8. Reel with a minimum of 30 metres / 100 feet of line
9. Two lift bags / delayed surface marker buoys (DSMB's) with a minimum of 12 kg / 25 lbs lift
10. Exposure suit adequate for the open water environment where training will be conducted
11. Access to an oxygen analyzer
12. Access to a helium analyzer
13. Adequate weight

32.9 Required Subject Areas

The *TDI Diving Rebreathers* Student Manual is required for use as a review/recap document. The instructor may use any additional text or materials they feel will represent the topic in an educational manner. The following topics must be covered during the course:

1. Gas Physiology
    a. Oxygen (O_2) toxicity
    b. Hypoxia

c. Nitrogen absorption
d. Helium absorption
e. HPNS
f. Carbon dioxide (CO_2) toxicity
g. Gas consumption
h. Gas mixing

2. Formula Work
    a. Oxygen (O_2) metabolizing calculations
    b. Manually controlled closed circuit rebreathers
    c. Equivalent narcosis depth theory
    d. Central nervous system (CNS) tracking
    e. Oxygen tracking units (OTU)
    f. Gas management
3. Dive Tables.
    a. Creation of custom dive tables appropriate to dive depths
    b. Creation of lower percentage of oxygen (PO_2) diluent to support loop flushing and bailout at depth
4. Dive Computers.
    a. Mix adjustable
    b. Constant partial pressure of oxygen (PPO_2)
    c. Oxygen (O_2) integrated
5. Dive Planning
    a. Operational planning
        i. Gas requirements including bailout scenarios
        ii. Decompression on a CCR
        iii. Oxygen limitations
        iv. Nitrogen limitations
        v. Helium limitations
6. Equipment Maintenance
    a. Fuel cell management
        i. Date stamps
        ii. Replacement
    b. Loop configurations
    c. Additional fitted equipment and modifications
        i. Auto diluent addition
        ii. Dual mode mouthpieces
        iii. Heads up display
        iv. Additional manual injectors
        v. Integrating oxygen monitors for dive computers

32.10 Required Skill Performance and Graduation Requirements

The following open water skills must be completed by the student during open water dives with the following course limits:

1. No dives deeper than 60 metres / 200 feet
2. No dives shallower than 40 meters / 130 feet, other than the 1 air diluent configuration dive are credited toward the dive requirements. Subsequent training dives in shallow water are permitted if necessary during the course.
3. Equivalent narcosis depth not to exceed 30 metres / 100 feet
4. Calculate all off-board gas at 45.30 litres /1.06 cubic feet per minute usage to cover stress situations
5. PO_2 not to exceed manufacturer recommendation or a working limit of 1.3 bar during the bottom phase of the dive and 1.4 bar during the decompression phase of the dive.
6. Diluent PO2 should not exceed 1.2 at maximum depth
7. All dives to be completed within appropriate fixed PO_2 decompression tables or decompression planning software
8. All dives to be completed within CNS percentage limits with a recommend maximum of 80 percent of the total PO_2 CNS limit
9. The student is only certified for CCR mixed gas diving on the rebreather being used

Land Drills

1. Build unit based on manufacturer's specifications using manufacturer's manual/build checklist
2. Demonstrate familiarity with basic and intermediate hand signals
3. Select and prepare equipment suitable for soft overhead environment with long decompression obligations
4. Conduct team oriented drills for lift bag deployment and bailout procedures
5. Drills for buddy rescue
6. Properly analyze all gas mixtures to be used
7. Demonstrate adequate pre-dive planning
    a. Limits based on system performance
    b. Limits based on bailout gas requirements
    c. Limits based on oxygen exposures at chosen PPO_2 levels
    d. Limits based on manually controlled closed circuit rebreathers
    e. Limits based on nitrogen absorption at planned depth and PPO_2 (set-point) level
    f. Limits based on helium absorption
    g. Correct narcotic depth planning and diluent selection to allow cell flushing at target depth (diluent should not exceed a PO2 of 1.2 at maximum planned depth)

Pre-dive Drills

1. Conduct pre-dive checks using TDI Pre-flight checklist
2. Use START* before every dive
3. Stress analysis and mitigation

Open Water Skills:

1. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices

2. Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet
3. Properly execute a recovery from a system failure and conclude the dive and decompression on open circuit gases carried
4. Properly execute a recovery from system failure and conclude the dive and decompression with the unit in manual mode
5. Gas shutdowns and loss of gas, correct choice and switching to off board gases
6. Broken hoses, catastrophic failure scenarios
7. Flooded absorbent canister
8. Cell errors
9. SCR drill (minimum of 10 minutes)
10. Oxygen rebreather mode in depths less than 6 metres / 20 feet
11. Stop at 3 to 6 metres / 10 to 20 feet on descent for leak bubble check
12. Demonstrate competence managing 2 bailout cylinders, including drop and recovery while maintaining position in the water column
13. Deployment of a lift bag / delayed surface marker buoy (DSMB) at depth and mid water
14. Simulate failed lift bag / DSMB deployment
15. On 2 of the dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression
16. Electronics systems monitoring for PPO_2 levels
17. Proper execution of the dive within all pre-determined dive limits
18. Demonstration of decompression stops at pre-determined depths
19. Demonstrate controlled ascent with toxed diver including surface tow at least 30 metres / 100 feet with equipment removal on surface, in water too deep to stand in

In order to complete the course and achieve the TDI Mixed Gas CCR rating the student must:

1. Complete to the instructors satisfaction all confined and open water skill development sessions
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Satisfactorily complete a written examination with a minimum score of 80 percent
4. Course must be completed within 6 weeks from the starting date
5. Complete a refresher course following a period of inactivity greater than 6 months following the course
6. course

33. Advanced Mixed Gas Closed Circuit Rebreather Diver, Unit Specific

33.1 Introduction

This is the highest level certification course for divers wishing to utilize the unit specific closed circuit rebreather (CCR) for advanced mixed gas diving. The objective of the course is to train divers in the benefits, hazards and proper procedures for advanced mixed gas diving on a CCR and to develop advanced CCR diving skills appropriate to technical diving to a maximum depth of 100 metres / 330 feet.

33.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in technical diving activities utilizing the unit specific CCR to a maximum depth of 100 metres / 330 feet utilizing any mixed gas diluent appropriate to the dive plan.

33.3 Who May Teach

An active TDI Instructor with a TDI unit specific advanced mixed gas CCR instructor rating

33.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. A maximum of 3 students per active TDI Instructor is allowed or 4 with a certified assistant

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 3 students per active TDI Instructor is allowed or 4 with a certified assistant
2. The ratio should be reduced as required due to environmental or operational constraints

Special Note: A certified assistant is a TDI Divemaster or equivalent from agencies recognized by TDI, with a advanced mixed gas CCR user qualification and a minimum of 120 hours logged diving on the CCR being taught.

33.5 Student Prerequisites

1. Minimum age of 18
2. Certified TDI CCR Mixed Gas Diluent diver, or equivalent from agencies recognized by TDI
3. Have a verified log of a minimum of 100 hours as a certified CCR diver over a minimum of 100 dives; a minimum of 50 hours and 50 dives must be on the unit specific CCR. Fifty percent of these dives must be deeper than 30 metres / 100 feet All dives to be deeper than 9 metres / 20 feet

33.6 Course Structure and Duration

Open Water Execution:

1. Minimum of 420 minutes open water training to be completed over a minimum of 7 dives including 1 equipment configuration and drills practice air diluent dive to a maximum 40 metres/ 130 feet
2. All subsequent dives to build incrementally in no greater than 10 metres / 33 feet steps
3. A minimum of 6 dives must be conducted on mixed gas diluent
4. All mixed gas dives are to be deeper than 40 metres / 130 feet
5. Five of the mixed gas dives must be decompression dives
6. In addition to meeting the course prerequisites, if the student is also qualified as a TDI Mixed Gas CCR Diver (any unit) or equivalent from agencies recognized by TDI then a minimum of only 240 minutes open water training is required over a minimum of 4 mixed gas decompression dives to build incrementally in no greater than 10 metres / 33 feet steps. Two dives must be deeper than 70 metres/ 230 feet
7. In addition to meeting the course prerequisites, if the student is also qualified as a TDI Advanced Trimix Diver or equivalent from agencies recognized by TDI then a minimum of only 240 minutes open water training is required over a minimum of 4 mixed gas decompression dives to build incrementally in no greater than 15 metres / 50 feet steps

Course Structure:

1. TDI allows instructors to structure courses according to the number of students participating and their skill level
2. The exam may be given orally if not available in a language the student understands

Duration:

1. Minimum of 6 hours for academic development and a further 2 hours for equipment configuration workshop

Special note: The maximum depth when teaching this course in the UK or Ireland is 75 metres / 245 feet due to H.S.E. requirements.

33.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the TDI Diver Registration Form to TDI Headquarters or registering the students online through member's area of the TDI website

33.8 Required Equipment

The following are required for this course:

1. *TDI Diving Rebreathers* Student Manual
2. Unit specific rebreather manual
3. *TDI Diving Rebreathers* PowerPoint Presentation
4. Manufacturer's manual and updates
5. Manufacturer's Build Checklist
6. *TDI CCR Preflight Checklist*

The following equipment is required for each student:

1. A complete unit specific CCR; this should be the student's personal unit
2. Minimum of 2 bottom timers and depth gauges or 1 CCR mixed gas computer and 1 bottom timer and depth gauge
3. Bailout gas supply in a minimum of 2 separate off-board oxygen clean cylinders; calculated at 45.30 litres /1.06 cubic feet per minute usage to cover stress situations
4. Two open circuit regulators and gauges fitted to the configuration
5. Mask, fins and a suitable line-cutting device
6. Slate and pencil
7. Reel with a minimum of 100 metres / 330 feet of line
8. Reel with a minimum of 50 metres / 165 feet of line
9. Two lift bags / delayed surface marker buoys (DSMB's) with a minimum of 12 kg / 25 lbs lift
10. Exposure suit adequate for the open water environment where training will be conducted
11. Access to an oxygen analyzer
12. Access to a helium analyzer
13. Adequate weight

33.9 Required Subject Areas

The *TDI Diving Rebreathers* Student Manual is required for use as a review/recap document. The instructor may use any additional text or materials they feel will represent the topic in an educational manner. The following topics must be covered during the course:

1. Gas Physiology
    a. Oxygen (O_2) toxicity
    b. Hypoxia
    c. Nitrogen absorption
    d. Helium absorption
    e. HPNS
    f. Carbon dioxide (CO_2) toxicity
    g. Gas consumption
    h. Gas mixing

2. Formula Work
    a. Oxygen (O_2) metabolizing calculations
    b. Manually controlled closed circuit rebreathers
    c. Equivalent narcosis depth theory
    d. Central nervous system (CNS) tracking
    e. Oxygen tracking units (out)
    f. Gas management
3. Dive Tables
    a. Creation of custom dive tables appropriate to dive depths
    b. Creation of lower percentage oxygen (PO_2) diluent to support loop flushing and bailout at depth
4. Dive Computers
    a. Mix adjustable
    b. Constant partial pressure of oxygen (PPO_2)
    c. Oxygen (O_2) integrated
5. Dive Planning
    a. Operational planning.
        i. Gas requirements including bailout scenarios
        ii. Oxygen limitations
        iii. Nitrogen limitations
        iv. Helium limitations
6. Equipment Maintenance
    a. Fuel cell management
        i. Date stamps
        ii. Replacement
    b. Loop configurations
    c. Additional fitted equipment and modifications
        i. Auto diluent addition
        ii. Dual mode mouthpieces
        iii. Heads up display
        iv. Additional manual injectors
        v. Integrating oxygen monitors for dive computers

33.10 Required Skill Performance and Graduation Requirements

The following open water skills must be completed by the student during open water dives with the following course limits:

1. No dives deeper than 100 metres / 330 feet
2. No dives shallower than 40 metres / 130 feet other than the 1 air diluent configuration dive
3. Equivalent narcosis depth not to exceed 30 metres / 100 feet
4. Calculate all off-board gas at litres 45.30 /1.06 cubic feet per minute usage to cover stress situations

5. PO_2 not to exceed manufacturer recommendation or a working limit of 1.3 bar during the bottom phase of the dive and 1.4 bar during the decompression phase of the dive
6. Diluent PO2 should not exceed 1.2 at maximum depth
7. All dives to be completed within appropriate fixed PO_2 decompression tables or decompression planning software
8. All dives to be completed within CNS percentage limits with a recommend maximum of 80 percent of the total PO_2 CNS limit
9. The student is only certified for CCR mixed gas diving on the rebreather being used

Pre-dive Drills

1. Conduct pre-dive checks using TDI Pre-flight checklist
2. Use START* before every dive
3. Stress analysis and mitigation

Land Drills

1. Build unit based on manufacturer's specifications using manufacturer's manual/build checklist
2. Demonstrate familiarity with basic and intermediate hand signals
3. Select and prepare equipment suitable for soft overhead environment with long decompression obligations
4. Conduct team oriented drills for lift bag deployment and gas switching procedure
5. Drills for buddy rescue
6. Properly analyze all gas mixtures to be used
7. Demonstrate adequate pre-dive planning
    a. Limits based on system performance
    b. Limits based on bailout gas requirements
    c. Limits based on oxygen exposures at chosen PPO_2 levels
    d. Limits based on manually controlled closed circuit rebreathers
    e. Limits based on nitrogen absorption at planned depth and PPO_2 (setpoint) level
    f. Limits based on helium absorption
    g. Correct narcotic depth planning and diluent selection to allow cell flushing at target depth (diluent should not exceed a PO2 of 1.2 at maximum planned depth)

Open Water Skills:

1. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices
2. Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet
3. Properly execute a recovery from a system failure and conclude the dive and decompression on open circuit gases carried
4. Properly execute a recovery from a system failure and conclude the dive and decompression with the unit in manual mode
5. Gas shutdowns and loss of gas, correct choice and switching to off board gases
6. Broken hoses, disaster scenarios
7. Flooded absorbent canister

8. Cell errors
9. SCR drill (minimum of 10 minutes)
10. Oxygen rebreather mode in depths less than 6 metres / 20 feet
11. Manually control CCR Unit for one full dive including all decompression stops
12. Demonstrate competence managing 3 bailout cylinders, including drop and recovery while maintaining position in the water column
13. Demonstrate proper understanding and implementation of team bailout procedures and conduct a team bailout from a depth greater than 40 metres/130ft
14. Demonstrate ability as a team to plug in and share off-board gas, including team sharing/swapping of off-board bailouts
15. On 2 of the dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression
16. Proper execution of the dive within all pre-determined dive limits
17. Ability to manage multiple failures in adverse conditions
18. Demonstrate of surface support/support divers in dealing with bailout scenarios

In order to complete the course and achieve the unit specific TDI Advanced Mixed Gas CCR rating the student must:

1. Complete to the instructor's satisfaction all confined and open water skill development sessions
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Satisfactorily complete a written examination with a minimum score of 80 percent
4. Course must be completed within 6 weeks from the starting date
5. Complete a refresher course following a period of inactivity greater than 6 months following the course

34. Air Diluent Closed Circuit Rebreather Diver Course Unit Specific- Poseidon Discovery MK VI / SE7EN / Se7en

34.1 Introduction

This is the TDI Diver level certification course for divers wishing to use the MK VI / SE7EN Discovery Closed Circuit Rebreather. The objective of this course is to train divers to develop basic rebreather diving skills appropriate to diving within the normal recreational depth limits for no decompression diving to 30 metres / 100feet using oxygen and an air diluent.

34.2 Qualifications of Graduates

Upon successful completion of this course, graduates may use the Poseidon MK VI / SE7EN CCR Air Diluent not to exceed the manufacturer's designed depth maximum or 30 metres / 100 feet with air diluent. This course is unit specific. Graduates may also enroll in the TDI CCR Decompression Procedures Unit Specific course after meeting the prerequisites for that course.

34.3 Who May Teach

1. Any active TDI CCR Rebreather Instructor with a MK VI / SE7EN Discovery qualification may teach this course.

34.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. A maximum of 4 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per instructor: it is the instructor's discretion to reduce this number as conditions dictate

34.5 Student Prerequisites

1. Minimum age, 18
2. Certified SDI Open Water Scuba Diver, or equivalent
3. Provide proof of 20 logged open water dives
4. Certified TDI Nitrox Diver, or equivalent: Nitrox course may be combined with this course

34.6 Course Structure and Duration

Confined Water Execution

1. Minimum of 60 minutes confined water training to a maximum of 9 metres / 30 feet

Open Water Execution

1. Minimum of 180 minutes open water training to be completed over a minimum of 4 dives with a gradual increase in depth each day to a maximum depth of 30 metres / 100 feet

Course Structure

1. TDI allows instructors trainers to structure courses according to the number of students participating and their skill level.

Duration:

1. Minimum of 4 hours academic development and 2 hours equipment maintenance workshop.
2. The duration of the entire course must be spread over a minimum of 3 days, with the open water dives being over a minimum of 2 days

Crossover

1. If a student is already qualified as TDI Air Diluent CCR Diver or equivalent from agencies recognized by TDI and wishes to qualify on another CCR recognized by TDI, the student must follow all unit specific course standards with the exception of:
    a. Minimum of 30 minutes confined water training to a maximum of 9 metres / 30 feet
    b. Minimum of 60 minutes open water training to be completed over a minimum of one dive to a maximum of 30 metres / 100 feet

34.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* form
    b. *TDI Medical Statement* form

Upon successful completion of the course the instructor trainer must:

1. Issue the appropriate TDI certification by submitting the appropriate TDI Diver Registration form to TDI Headquarters or registering the students online through the member's area of the TDI website

34.8 Training Material

Required Material

1. *TDI Diving Rebreathers* Instructor Guide
2. *TDI Diving Rebreathers* Rebreather Diver Manual

3. *TDI Standards and Procedures* Instructor Manual
4. Rebreather Course Evaluation Form
5. Poseidon Discovery MK IV User Manual
6. Manufacturer's Build Checklist
7. *TDI CCR Preflight Checklist*

Optional Material

1. *TDI Diving Rebreathers* PowerPoint Presentation Series
2. Richard Pyle - *A Learners Guide to Closed Circuit Rebreather Operations*
3. Kenneth Donald - *Oxygen & The Diver*
4. John Lamb – *Oxygen Measurement for Divers*
5. Barsky, Thurlow & Ward - *The Simple Guide to Rebreather Diving*
6. Bob Cole – *Rebreather Diving*
7. Jeffrey Bozanic – *Mastering Rebreathers*

34.9 Required Equipment

The following equipment is required for each student:

1. The student must own, or have access to the MK VI / SE7EN Discovery CCR
2. Mask, fins
3. Exposure suit suitable for the diving environment
4. Knife
5. Slate and pencil
6. Bailout cylinder with a minimum capacity of 3 litres / 21 cubic feet
7. Ascent reel with lift bag / surface marker buoy appropriate for maximum planned depth

34.10 Required Subject Areas

Instructor's must use the *TDI Diving Rebreathers* Student manual, instructor guide, manufacturer's manual and the current *TDI Standards and Procedures* Manual, but may also use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. History and Evolution of Rebreathers
2. Comparison of Open Circuit, Closed Circuit and Semi Closed Circuit Rebreather systems and the Benefits/Problems with each
3. Practical Mechanics of the System
    a. Assembly and disassembly of the MK VI / SE7EN Discovery
    b. Layout and design of the unit
    c. Absorbent canister design and maintenance
    d. Breathing loop de-contamination procedures
    e. Automatic diluent valve (ADV)
    f. Keying valve to individuals metabolic rate

g. Valve maintenance
h. DSV (mouthpiece) use, design and limitations

4. Gas Physiology
    a. Oxygen toxicity
    b. Nitrogen absorption
    c. CO_2 toxicity
    d. Gas consumption
5. Electronic Systems Design and Maintenance
    a. O_2 metabolizing calculations
    b. Equivalent air depth (EAD) theory
    c. Fuel cells
    d. Configuration software
    e. System electronics functionality and power-up self test
    f. Controlling resources
        i. Oxygen supply
        ii. RNDT
        iii. OTU
        iv. Amount of diluent
        v. Battery supply
    g. Time to surface (TTS) alarm
    h. Smart Battery condition / testing
        i. Charge times
        ii. Learn cycles
        iii. 40 metre / 132 feet no deco
    i. Firmware updating
6. Dive Tables.
    a. Equivalent air depth (EAD) operation
    b. Constant PPO_2 theory
    c. CNS and awareness of OTU tracking
    d. Dive computers
    e. Mix adjustable
    f. Constant PO_2
    g. O_2 integrated
7. Dive Planning
    a. Operational planning
    b. Gas requirements including on-board open circuit bailout scenarios / limitations
    c. Oxygen limitations
    d. Nitrogen limitations
    e. Off board open circuit bailout
8. Emergency Procedures.

a. Use of B.A.D.D.A.S.S.
b. Three H's problems
c. Flooded loop
d. Cell warnings
e. Battery warnings / failure

34.11 Required Skill Performance and Graduation Requirements

The following skills must be completed by the diver. The maximum training depth shall not exceed 30 metres / 100 feet. Over the course of the practical sessions, divers must set up and break down the Poseidon MK VI / SE7EN a minimum of 4 times running through the start-up procedures each time.

1. Demonstrate properly analysis of all gas mixtures to be used
2. Demonstrate proper loading of scrubber canister
    a. Cartridge properly oriented top and bottom
    b. Top plate inspection and inserting
    c. Canister sponge inspection
3. Demonstrate a complete systems check and rebreather configuration
4. Demonstrate appropriate pre-dive planning
    a. Limits based on personal gas consumption
    b. Limits based on oxygen consumption and exposures at planned depth
    c. Limits based on nitrogen absorption at planned depth
5. Properly execute the planned dive within all pre-determined limits
6. Demonstrate the proper procedures for
    a. Buoyancy control with minimal air use
    b. ADV use
    c. Mask clearing with minimal air loss
    d. Bail-out
        i. On-board with ascent
        ii. Off-board while maintaining depth (switch back to loop before ascent)
    e. Mouthpiece removal
    f. Clearing loop of water
    g. Ascent techniques
    h. Simulated emergency
        i. Buddy checks
        ii. Safety stops
7. Properly execute the break down and maintenance of rebreather
8. Post dive clean of unit
    a. Mouth piece and hoses
    b. Clean and disinfect unit
    c. Inspect components of unit

9. Diver maintenance of unit
    a. Cell remove and replace
    b. Mouthpiece strip and rebuild
    c. Smart battery
        i. Proper storage
        ii. When to replace

In order to complete this course, students must:

1. Satisfactorily complete the *TDI Diving Rebreathers* Course written examination with an 80%, and 100% remediation
2. Demonstrate mature, sound judgment concerning training, dive planning and execution
3. Complete all open water requirements safely and efficiently
4. Demonstrate proficiency in the TDI Closed Circuit Rebreather Diver Program

35. Air Diluent Closed Circuit Rebreather Decompression Procedures Diver Course Unit Specific- Poseidon Discovery MK VI / SE7EN / Se7en

35.1 Introduction

This is the diver level certification course for divers wishing to use the Poseidon MK VI / SE7EN Unit Closed Circuit Rebreather (CCR) for decompression procedures diving. The objective of this course is to train divers and to develop basic rebreather diving skills appropriate to diving within the normal recreational depth limits for decompression diving to 40 metres / 130 feet using oxygen and an air diluent.

35.2 Qualifications of Graduates

Upon successful completion of this course, graduates may use the Poseidon MK VI / SE7EN CCR for Air Diluent Decompression Procedures diving, not to exceed the manufacturers designed depth maximum of 40 metres / 130 feet. This course is manufacturer specific.

35.3 Who May Teach

1. Any active TDI Poseidon MK VI / SE7EN CCR Air Diluent Decompression Procedures Rebreather Instructor may teach this course.

35.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to insure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. A maximum of 4 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

35.5 Student Prerequisites

1. Minimum age, 18
2. Certified as a TDI Poseidon MK VI / SE7EN Closed Circuit Rebreather Diver, or equivalent
3. 30 hours on the Poseidon MK VI / SE7EN Closed Circuit Rebreather

OR

1. Minimum age 18
2. Provide proof of 50 logged dives
3. Provide proof of a TDI Advanced Nitrox Diver and Deco Procedures Diver, or equivalent from agencies recognized by TDI

35.6 Course Structure and Duration

Confined Water Execution

1. Minimum of 60 minutes confined water training to a maximum of 9 metres / 30 feet

Open water execution

1. Minimum of 420 minutes open water training, to be completed over a minimum of 7 dives with a gradual increase in depth each day to a maximum of 40 metres / 130 feet

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level
2. The final exam may be given orally if not available in a language the student understands

Duration

1. Minimum of 6 hours academic development and 2 hours equipment maintenance workshop
2. The duration of the entire course must take a minimum of 5 days

Crossover

1. If a student already qualified as TDI CCR Air Diluent Deco Diver or equivalent from an agency recognized by TDI and wishes to qualify on another CCR recognized by TDI, the student must follow all unit specific course standards with the exception of:
    a. Minimum of 60 minutes confined water training to a maximum of 9 metres / 30 feet
    b. Minimum of 180 minutes open water training to be completed over a minimum of 3 dives to a maximum of 40 metres / 130 feet

Upgrades

1. If a student has the entry level 1 certification and wishes to do the decompression part of this course, only 240 minutes in open water is required
2. The student must have a minimum of 30 logged hours over 30 dives before enrolment on the deco course
3. Six months CCR diving experience

35.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:

a. *TDI Liability Release and Express Assumption of Risk* form
b. *TDI Medical Statement* form

Upon successful completion of the course the instructor trainer must:

1. Issue the appropriate TDI certification by submitting the appropriate TDI Diver Registration form to TDI Headquarters or registering the students online through the member's area of the TDI website

35.8 Training Material

Required material

1. TDI Diving Rebreathers Instructor Guide
2. TDI Diving Rebreathers Diver Manual
3. TDI Standards and Procedures Instructor Manual
4. Rebreather Course Evaluation Form
5. Poseidon Discovery MK VI / SE7EN User Manual
6. Manufacturer's Build Checklist
7. *TDI CCR Preflight Checklist*

Optional Material

1. *TDI Diving Rebreathers* PowerPoint Presentation Series
2. Richard Pyle - *A Learners Guide to Closed Circuit Rebreather Operations*
3. Kenneth Donald - *Oxygen & The Diver*
4. John Lamb – *Oxygen Measurement for Divers*
5. Barsky, Thurlow & Ward - *The Simple Guide to Rebreather Diving*
6. Bob Cole – *Rebreather Diving*
7. Jeffrey Bozanic – *Mastering Rebreathers*

35.9 Required Equipment

The following equipment is required for each student:

1. The student must own, or have access to the MK VI / SE7EN Discovery CCR
2. Depth gauge and automatic bottom timer and / or dive computer
3. Mask, fins
4. Exposure suit suitable for the diving environment
5. Knife
6. Slate and pencil
7. Bailout cylinder with a minimum capacity of 5 litres / 40 cubic feet
8. Ascent reel with lift bag / surface marker buoy appropriate for maximum planned depth minimum of 12 kg / 25 lbs

35.10 Required Subject Areas

Instructor must use the *TDI Diving Rebreathers* Student manual, instructor guide, manufacturer's manual and the current *TDI Standards and Procedures* Manual, but may also use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. History and Evolution of Rebreathers
2. Comparison of Open Circuit, Closed Circuit and Semi Closed Circuit Rebreather systems and the Benefits/Problems with each
3. Practical Mechanics of the System
    a. Assembly and disassembly of the MK VI / SE7EN Discovery
    b. Layout and design of the unit
    c. Absorbent canister design and maintenance
    d. Breathing loop de-contamination procedures
    e. Automatic diluent valve (ADV)
    f. Keying valve to individuals metabolic rate
    g. Valve maintenance
    h. DSV (mouthpiece) use, design and limitations
4. Gas Physiology
    a. Oxygen toxicity
    b. Nitrogen absorption
    c. CO_2 toxicity
    d. Gas consumption
5. Electronic Systems Design and Maintenance
    a. O_2 metabolizing calculations
    b. Equivalent air depth (EAD) theory revision
    c. Fuel cells
    d. Configuration software
    e. System electronics functionality and power-up self test
    f. Controlling Resources
        i. Oxygen supply
        ii. RNDT (modified with 40 metres / 130 feet deco battery)
        iii. OTU
        iv. Amount of diluent
        v. Battery supply
    g. Time to surface alarm (TTS)
    h. Smart battery condition / testing
        i. Charge times
        ii. Learn cycles
        iii. 40 metre / 130 feet deco
    i. Firmware updating

6. Dive Tables
    a. Equivalent air depth (EAD) operation
    b. Constant PPO_2 theory
    c. CNS and awareness of OTU tracking
7. Dive Computers
    a. Mix adjustable
    b. Constant PO_2
    c. O_2 integrated
8. Dive Planning
    a. Operational planning
    b. Gas requirements including on-board open circuit bailout scenarios / limitations
    c. Oxygen limitations
    d. Nitrogen limitations
    e. Off board open circuit bailout
    f. Planning for bailout / deco OC gas requirements
9. Emergency Procedures
    a. Omitted decompression procedures
    b. Use of B.A.D.D.A.S.S.
    c. Three H's problems
    d. Flooded loop
    e. Cell warnings
    f. Battery warnings / failure
    g. Use of the DSV / ADV for diluent flushes on the MK VI / SE7EN

35.11 Required Skill Performance and Graduation Requirements

The following skills must be completed by the diver. The maximum training depth shall not exceed the manufacturer's design limit. Over the course of the practical sessions, divers must set up and break down the Poseidon MK VI / SE7EN a minimum of 4 times running through the start-up procedures each time.

1. Demonstrate properly analysis of all gas mixtures to be used
2. Demonstrate proper loading of scrubber canister
    a. Cartridge properly oriented top and bottom
    b. Top plate inspection and inserting
    c. Canister sponge inspection
3. Demonstrate a complete systems check and rebreather configuration
4. Demonstrate appropriate pre-dive planning
    a. Limits based on personal gas consumption
    b. Limits based on oxygen consumption and exposures at planned depth
    c. Limits based on nitrogen absorption at planned depth
5. Properly execute the planned dive within all pre-determined limits

6. Demonstrate the proper procedures for
    a. Buoyancy control with minimal air use
    b. ADV use
    c. Mask clearing with minimal air loss
    d. Bail-out
        i. On-board with ascent while safely conducting any simulated decompression obligations
        ii. Off-board while maintaining depth (switch back to loop before ascent)
    e. Mouthpiece removal
    f. Clearing loop of water
    g. Ascent techniques
    h. Simulated emergency
        i. Omitted decompression procedures
        ii. Buddy checks
        iii. Safety stops
7. Properly execute the break down and maintenance of rebreather
8. Post dive clean of unit
    a. Mouth piece and hoses
    b. Clean and disinfect unit
    c. Inspect components of unit
9. Diver maintenance of unit
    a. Cell remove and replace
    b. Mouthpiece strip and rebuild
    c. Smart battery
        i. Proper storage
        ii. When to replace

In order to complete this course, students must:

1. Satisfactorily complete the *TDI Diving Rebreathers* Course written examination with an 80%, and 100% remediation
2. Demonstrate mature, sound judgment concerning training, dive planning and execution
3. Complete all open water requirements safely and efficiently
4. Demonstrate proficiency in the TDI Closed Circuit Rebreather Diver Program

36. Mixed Gas Closed Circuit Rebreather Diver Course Unit Specific- Poseidon Discovery MK VI / SE7EN / Se7en

36.1 Introduction

This is the diver level certification course for divers wishing to use the Poseidon MK VI / SE7EN for mixed gas closed circuit rebreather diving. The objective of this course is to train divers to perform mixed gas rebreather diving, and to develop technical rebreather diving skills appropriate to diving to a maximum depth 48 metres / 157 feet or the maximum depth set by the manufacturer, using trimix with a minimum 16 percent oxygen (O_2) or greater.

36.2 Qualifications of Graduates

Upon successful completion of this course, graduates may use the Poseidon MK VI / SE7EN CCR for mixed gas diving, not to exceed the manufacturer's designed depth maximum of 48 metres / 157 feet. This course is manufacturer specific.

36.3 Who May Teach

1. An active TDI Poseidon MK VI / SE7EN Mixed Gas Instructor

36.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. A maximum of 2 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 2 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

36.5 Student Prerequisites

1. Minimum age 21
2. 15 MK VI / SE7EN logged dives

And

3. TDI Poseidon MK VI / SE7EN CCR Air Diluent Decompression Procedures diver, or equivalent

OR

4. TDI Decompression Procedures Diver (Open Circuit) or equivalent

OR

5. TDI Mixed Gas CCR Diver or equivalent

36.6 Course Structure and Duration

Open Water Execution

1. Minimum of 360 minutes open water training to be completed over a minimum of 6 dives including 1 equipment configuration and drills practice air diluent dive to a maximum 40 metres / 130 feet
2. All subsequent dives to build incrementally in no greater than 10 metres / 33 feet steps
3. Only 1 dive is on air diluent all others are to be mixed gas dives
4. All mixed gas dives are to be deeper than 40 metres / 130 feet, utilizing a mixed gas diluent containing 16 percent or greater oxygen
5. Four dives must be decompression dives

Course Structure

6. TDI allows instructors to structure courses according to the number of students participating and their skill level
7. The final exam may be given orally if not available in a language the student understands

Duration

1. Minimum of 6 hours for academic development and a further 2 hours for equipment configuration workshop

Special note: If the diver is already open circuit trimix certified, 6 dives and 360 minutes is still required.

36.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the instructor candidates
2. Ensure that the diver has the required equipment
3. Communicate the training schedule
4. Have the diver:
    a. Complete the *TDI Liability Release and Express Assumption of Risk* form
    b. Submit the *TDI Medical Statement* form signed by a licensed physician

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the appropriate TDI Diver Registration form to TDI Headquarters or registering the students online through the member's area of the TDI website

36.8 Training Material

Required Material:

1. *TDI Diving Rebreathers* Diver Manual

2. *TDI Diving Rebreathers* Instructor Guide
3. TDI Standards and Procedures Instructor Manual
4. Rebreather Course Evaluation Form
5. Poseidon Discovery MK IV User Manual
6. Manufacturer's Build Checklist
7. *TDI CCR Preflight Checklist*

Optional Material

1. *TDI Diving Rebreathers* PowerPoint Presentation Series
2. Richard Pyle - *A Learners Guide to Closed Circuit Rebreather Operations*
3. Kenneth Donald - *Oxygen & The Diver*
4. John Lamb – *Oxygen Measurement for Divers*
5. Barsky, Thurlow & Ward - *The Simple Guide to Rebreather Diving*
6. Bob Cole – *Rebreather Diving*
7. Jeffrey Bozanic – *Mastering Rebreathers*

36.9 Required Equipment

The following equipment is required for each student:

1. The student must own, or have access to Poseidon MK VI / SE7EN CCR
2. Depth gauge and automatic bottom timer and / or dive computer
3. Mask, fins
4. Exposure suit suitable for the diving environment
5. Knife
6. Slate and pencil
7. Bailout cylinder with a minimum capacity of 5 litres / 40 cubic feet
8. Ascent reel with lift bag / surface marker buoy appropriate for maximum planned depth minimum of 12 kg / 25 lbs

36.10 Required Subject Areas

Instructor must use the *TDI Diving Rebreathers* Student Manual, instructor guide, manufacturer's manual and the current *TDI Standards and Procedures* Manual, but may also use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. History and Evolution of Rebreathers
2. Comparison of Open Circuit, Closed Circuit and Semi Closed Circuit Rebreather Systems and the Benefits/Problems with Each
3. Practical Mechanics of the System
    a. Assembly and disassembly of the MK VI / SE7EN Discovery
    b. Layout and design of the unit

c. Absorbent canister design and maintenance
d. Breathing loop de-contamination procedures
e. Automatic Diluent Valve (ADV)
f. Keying valve to individuals metabolic rate
g. Valve maintenance
h. DSV (mouthpiece) use, design and limitations

4. Gas Physiology
    a. Oxygen toxicity
    b. Nitrogen absorption
    c. Helium
    d. CO_2 toxicity
    e. Gas consumption
5. Electronic Systems Design and Maintenance
    a. O_2 metabolizing calculations
    b. Equivalent air depth (EAD) theory revision
    c. Fuel cells
    d. Configuration software
    e. System electronics functionality and power-up self test
    f. Controlling resources
        i. Oxygen supply
        ii. RNDT (modified with 48 metres / 157 feet Deco Trimix Battery)
        iii. OTU
        iv. Amount of diluent
        v. Battery supply
    g. Time to surface alarm (TTS)
    h. Smart Battery condition / testing
        i. Charge times
        ii. Learn cycles
        iii. 48 metre / 157 feet deco trimix
    i. Firmware updating
6. Dive Tables
    a. Equivalent air depth operation
    b. Constant PPO_2 theory
    c. CNS and awareness of OTU tracking
7. Dive Computers
    a. Mix adjustable
    b. Constant PO_2
    c. O_2 integrated
8. Dive Planning
    a. Operational planning

   b. Gas requirements including on-board open circuit bailout scenarios / limitations
   c. Oxygen limitations
   d. Nitrogen limitations
   e. Off board open circuit bailout
9. Emergency Procedures
   a. Omitted decompression procedures
   b. Use of B.A.D.D.A.S.S.
   c. Three H's problems
   d. Flooded loop
   e. Cell warnings
   f. Battery warnings / failure

36.11 Required Skill Performance and Graduation Requirements

The following skills must be completed by the diver. The maximum training depth shall not exceed 48 metres / 157 feet.

The following skills must be completed by the diver. The maximum training depth shall not exceed the manufacturers design limit. Over the course of the practical sessions, diver(s) must set up and break down the Poseidon MK VI / SE7EN a minimum of 4 times running through the start-up procedures each time.

1. Demonstrate proper analysis of all gas mixtures to be used
2. Demonstrate proper loading of scrubber canister
   a. Cartridge properly oriented top and bottom
   b. Top plate inspection and inserting
   c. Canister sponge inspection
3. Demonstrate a complete systems check and rebreather configuration
4. Demonstrate appropriate pre-dive planning
   a. Limits based on personal gas consumption
   b. Limits based on oxygen consumption and exposures at planned depth
   c. Limits based on nitrogen absorption at planned depth
5. Properly execute the planned dive within all pre-determined limits
6. Demonstrate the proper procedures for
   a. Buoyancy control with minimal air use
   b. ADV use
   c. Mask clearing with minimal air loss
   d. Bail-out
      i. On-board with ascent while safely conducting any simulated decompression obligations
      ii. Off-board while maintaining depth (switch back to loop before ascent)
   e. Mouthpiece removal
   f. Clearing loop of water
   g. Ascent techniques

   h. Simulated emergency
      i. Omitted decompression procedures
   i. Buddy checks
   j. Safety stops
7. Properly execute the break down and maintenance of rebreather
8. Post dive clean of unit
   a. Mouth piece and hoses
   b. Clean and disinfect unit
   c. Inspect components of unit
9. Diver maintenance of unit
   a. Cell remove and replace
   b. Mouthpiece strip and rebuild
   c. Smart battery
      i. Proper storage
      ii. When to replace

In order to complete this course, students must:

1. Satisfactorily complete the *TDI Diving Rebreathers* Course written examination with an 80%, and 100% remediation
2. Demonstrate mature, sound judgment concerning training, dive planning and execution
3. Complete all open water requirements safely and efficiently
4. Demonstrate proficiency in the TDI Closed Circuit Rebreather Diver Program

37. Explorer Rebreather Diver

37.1 Introduction

This is the entry-level certification course for recreational divers wishing to utilize the Explorer rebreather. The objective of this course is to train recreational divers in the benefits, hazards and proper procedures for using the Explorer rebreather.

37.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in non decompression diving activities utilizing the Explorer to a maximum depth of 40 metres / 130 feet, not to exceed the maximum depth of the diver's current certification, without decompression, utilizing nitrox mixes of 32 – 40%

37.3 Who May Teach

1. Any active Hollis Explorer Sport Rebreather Instructor may teach this course.

37.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. A maximum of 6 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 6 students per instructor; it is the instructor's discretion to reduce this number as conditions dictate

37.5 Student Prerequisites

1. Minimum age 18, 15 with parental consent
2. Minimum certification of TDI Nitrox Diver, or equivalent, may be combined in program at the discretion of the instructor
3. If student has less than 25 logged dives, a mandatory one hour confined session is required

37.6 Course Structure and Duration

Confined Water

1. For divers requiring a one hour confined water session, they must perform each of the required open water skills a minimum of one time and demonstrate an ability to control buoyancy while maintaining loop volume control.

Open Water Execution

1. A minimum of 4 dives with a minimum of 100 accumulated minutes

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level
2. Dives conducted to a maximum depth of 40 metres / 130 feet, not to exceed the maximum depth of the diver's current certification

Duration

1. The minimum number of classroom and briefing hours is 6
2. The Minimum course duration is 2 days

37.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form
    c. Other Manufacturer forms as required by the manufacturer

Upon successful completion of the course the instructor must:

1. Issue the appropriate certification by submitting the Diver Registration Form to TDI or registering the students online through the TDI member's area of the website

37.8 Training Material

Required Material

1. *TDI Diving Rebreathers* Student Manual
2. Hollis Explorer user's manual

Optional Material

1. TDI plastic EAD and PO_2 tables
2. *TDI Diving Rebreathers* PowerPoint Presentation
3. Nitrox and rebreather equations software
4. Other manufacturer support materials

37.9 Required Equipment

The following equipment is required for each student:

1. A complete Explorer rebreather
2. Printed checklists from the owner's manual
3. Access to oxygen analyzer (instructor may supply)
4. Appropriate CO_2 absorbent for the dives to be conducted
5. Underwater slate
6. Toolkit with appropriate spares (instructor may supply)
7. Disinfectant (instructor may supply)
8. One line cutting device
9. Mask and fins
10. Exposure suit appropriate for the open water environment
11. Weight / weight system
12. Appropriately sized gas cylinder with mix appropriate for the depth of the dive
13. Off board bailout required for dives deeper than 18 metres / 60 ft. with appropriate volume for maximum planned depth

37.10 Required Subject Areas

The *TDI Diving Rebreathers* Student Manual and the manufacturer's manual are mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. History and Evolution of Rebreathers
2. Comparison of Open Circuit, Closed Circuit, and Semi-closed Circuit Units
3. Practical Mechanics of the Explorer Rebreather System
    a. Assembly and disassembly of the Explorer rebreather
    b. Layout and design
    c. Scrubber replacement
    d. Pre-dive safety check sequence
    e. System maintenance and storage
    f. Breathing loop decontamination procedures
4. Review of Nitrox
    a. Dalton's Law (triangle)
    b. Optimum nitrox mix
    c. Oxygen tracking
    d. Gas preparation and analysis
5. Gas Physiology
    a. Oxygen toxicity
    b. Hyperoxia

c. Hypoxia
d. Asphyxia
e. Hypercapnia
f. Nitrogen absorption
g. CO_2 toxicity
h. Gas consumption
i. Cylinder sizes

6. Formula Work
    a. Cylinder size/duration equation
    b. Equivalent air depth
7. Dive Tables
    a. Equivalent air depth
    b. CNS toxicity tables
    c. NDL tables
8. Dive Computers
    a. Mix adjustable
    b. Oxygen integrated
    c. PO_2 monitoring devices
9. Dive Planning
    a. Operational planning
    b. Gas requirements including bailout scenarios
    c. Oxygen limitations
    d. Nitrogen limitations
    e. PSCR and FO_2 drop
10. Problem Solving
    a. Unit flooding
    b. Mouthpiece loss
    c. Scrubber exhaustion
    d. Battery or sensor failure
    e. Resource alarms
    f. Open circuit bailout
    g. Hyperoxia scenario
    h. Hypoxia scenario
    i. Hypercapnia scenario
    j. Post problem maintenance of equipment

37.11 Required Skill Performance and Graduation Requirements

The dive depth shall not exceed 1.4 ATM PO_2. The following skills must be completed by the student during open water dives:

1. 1 dry setup and breakdown during lecture
2. Properly analyze gas mixture
3. Perform all pre dive checks, a minimum of 4 times
4. Complete pre-dive checklist
5. Demonstrate a leak check and repair scenario
6. Properly packing a scrubber canister a minimum of 2 times
7. Properly execute set-up and breakdown; a minimum of 2 times
8. Demonstrate adequate pre-dive planning
    a. Limits based on system performance
    b. Limits based upon oxygen exposures at planned depth with mix
    c. Limits based upon nitrogen absorption at planned depth with mix
9. Properly execute the planned dives within all pre-determined limits
10. Properly execute a recovery from a system failure and switch to bail-out stationary a minimum of 2 times
11. Properly execute two bailout scenarios due to a simulated system failure. From 18 metres / 60 feet or shallower, bailout to BOV and execute proper safety stop and ascent. For dives deeper than 18 metres / 60 feet, one bailout scenario must be conducted on off board bailout, but executed no deeper than 30 metres / 100 feet. Properly demonstrate hose clearing technique after each bail-out scenario
12. Proper PO_2 monitoring on all dives
13. Perform adjustments to the wrist unit during a dive a minimum of 2 times
14. Properly execute a mask clearing exercise with emphasis on minimal gas loss
15. Safely and properly execute a buddy out of air scenario, it is preferable the buddy is on a SCR unit also
16. Diver will demonstrate actual safety stops at pre-determined depths
17. Properly execute cleaning and maintenance of the rebreather, including breathing loop decontamination

In order to complete this course, students must:

1. Satisfactorily complete the *TDI Diving Rebreathers* course written examination
2. Complete all open water requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution

38. Rebreather Cavern Diver

38.1 Introduction

This course is designed to develop the minimum skills and knowledge for diving a TDI approved rebreather in cavern and overhead environments within the limits of light penetration; in addition, outline specific hazards associated with rebreather cave diving. The Rebreather Cavern course is not intended to provide instruction for diving in cave environments. The objective of this course is to train divers in the proper planning, procedures, techniques and hazards of rebreather cavern diving.

38.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in rebreather cavern diving activities without direct supervision provided the graduates adhere to the following limits:

1. Daylight zone, i.e. within natural light of the cavern entrance
2. Diver carries adequate bailout to safely exit from the furthest point of penetration using a minimum SAC rate of 30 litres per minute/1 cubic foot per minute OR the student's calculated elevated SAC rate to account for a CO_2 event, whichever is greater
3. 60 linear metres / 200 linear feet from the surface
4. 30 metres / 100 feet maximum depth
5. No decompression diving
6. No restrictions; no areas too small for 2 divers to pass side-by-side
7. Safety stops as appropriate or necessary
8. Maintain a continuous guideline
9. Proper cavern diving equipment is used in conjunction with a TDI approved rebreather
10. No removal of life support equipment shall be permitted within the overhead environment
11. Visibility must be adequate to identify the exit from inside the cavern

Upon successful completion of this course, graduates are qualified to enroll in:

1. TDI Rebreather Introductory Cave Diver course

38.3 Who May Teach

1. Any active TDI Rebreather Full Cave Diver Instructor qualified to teach on the TDI approved rebreather used may teach this course

38.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Open Water

1. A maximum of 4 students per active TDI instructor

Cavern

1. A maximum of 3 students per active TDI Instructor are allowed; ratio should be reduced as required due to environmental or operational constraints

38.5 Student Prerequisites

1. Minimum age 18
2. Provide proof of TDI Air Diluent CCR diver or equivalent
3. Provide proof of a minimum of 25 logged dives and 25 hours on the specific unit

38.6 Course Structure and Duration

Water Execution

1. Minimum of 5 dives must be conducted including
    a. 1 open water session
    b. Four cavern dives with a minimum total bottom time of 120 minutes conducted at 2 different sites
2. Visibility must be adequate to identify the exit from inside the cavern

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 6
2. Course must be conducted over a minimum of 2 days

38.7 Administrative Requirements

The following are the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment and certifications
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the *TDI Diver Registration* Form or registering the students online through member's area of the TDI website

38.8 Required Equipment

The following are required for this course

1. *TDI Diving in Overhead Environments* Manual
2. *TDI Diving in Overhead Environments* Instructor Guide
3. *TDI Diving in Overhead Environments* Instructor Resource CD (Optional)
4. *TDI Diving Rebreathers* Student Manual
5. *TDI Diving Rebreathers* PowerPoint Presentation (optional)
6. Rebreather Manufacturer's manual and updates
7. Manufacturer's Build Checklist
8. *TDI CCR Preflight Checklist*

Suggested reading materials

1. *NACD Art of Safe Cave Diving*
2. *Basic Cave Diving – A Blueprint for Survival*
3. *CDAA - Cavern / Sinkhole* Manual
4. *NSS-CDS Cavern* Manual

The following equipment is required for each student:

1. A complete TDI approved rebreather
2. Minimum of 1 rebreather enabled computer or PO_2 monitoring device
3. Bailout cylinder(s) with volume appropriate for the dive
4. Bailout regulator(s) equipped with pressure gauge and low pressure off board (quick connect) gas supply hose.
5. Access to an oxygen analyzer (instructor may supply)
6. Buoyancy compensator device (BCD)
7. Exposure suit adequate for cavern environment
8. Mask and fins
9. Line cutting device
10. Safety reel with a minimum of 37 metres / 125 feet of guideline
11. One primary reel with length appropriate for intended dive
12. Three battery powered lights; 1 primary and 2 back-ups, each with a burn time suitable for the planned dive time
13. Slate or wet notes and pencil
14. Submersible dive tables or backup dive computer
15. Three directional line arrows
16. Weight system

Instructor must use full cave diving equipment during all water exercises

38.9 Required Subject Areas

The following topics must be covered during this course:

1. Policy for Cavern Diving
2. Psychological Considerations
3. Equipment Considerations
    a. Bailout cylinder options
        i. Single bailout cylinder vs redundant
        ii. Long hose vs short hose on bailout
    b. Rebreather configuration options
    c. Buoyancy compensator device (BCD)/ harness options
    d. Scrubber options
    e. Reel options
    f. Proper weighting
    g. Equipment configurations
4. Communication
    a. Hand signals
    b. Light signals
    c. Touch contact signals
5. Swimming Techniques
    a. Body posture/ trim
    b. Buoyancy control
    c. Line following
    d. Propulsion techniques
6. Physiology
    a. Breathing techniques
    b. Stress management
7. Cavern Environment
    a. Geology
        i. Bottom
        ii. Ceiling
    b. Local access requirements
    c. Land owner relations
8. Cavern Conservation
9. Problem Solving
    a. Emergency procedures
    b. Equipment failure
    c. Silting conditions
10. Bailout Gas Volume Requirements
11. Accident Analysis
12. Review of Dive Tables and Decompression Theory
13. Cavern Diving with Open Circuit Divers
    a. Bailout configuration requirements

b. Out of air emergencies

14. Cavern Diving Etiquette

38.10 Required Skill Performance and Graduation Requirements

At NO point is the student to be unable to monitor their PO_2 while on the loop. Zero visibility drills must be performed in a way that the student may monitor the status of the breathing loop, i.e. no mask but able to monitor HUD, lights out but able to use display lighting to view PO_2, etc. Or, the drill must be done on bailout.

The following land drills must be covered during this course:

1. How to properly:
    a. Deploy a guideline
    b. Follow a guideline
    c. Conduct bail out exit including bottle swapping while following a guideline
    d. Conduct bail out exit including bottle swapping simulating zero visibility and using touch contact while following a guideline
2. Touch contact communicate
3. Correctly deploy directional markers

The student must perform the following S-drill and skills during all dives:

1. Demonstrate:
    a. Adequate pre-dive planning
    b. Equipment check and equipment matching
    c. Bubble check
    d. Specialized propulsion techniques
    e. Proper buoyancy control
    f. Proper body posture
    g. Proper PO_2 management
    h. Overall rebreather instruments analysis
    i. Proper stress analysis (detection and management)

The student must complete the following skills in a non-overhead environment prior to entering the cavern:

1. Properly:
    a. Deploy a guideline
    b. Follow a guideline
    c. Conduct bail out exit including bottle swapping while following a guideline
    d. Conduct bail out exit including bottle swapping simulating zero visibility and using touch contact while following a guideline
2. Touch contact communicate
3. Correctly deploy directional markers

The student must perform the following in-water skills during cavern dives:

1. Properly:
    a. Deploy a guideline
    b. Use directional line markers
    c. Follow a guideline
    d. Follow a guideline simulating loss of visibility
2. Perform bailout exit practicing bottle swapping with teammates:
    a. Following the guideline
    b. Simulating zero visibility and using touch contact, following the guideline
3. Remove and replace mask while in contact with guideline
4. Demonstrate light / hand signals and touch contact
5. Explore cavern
6. Execute proper conservation and awareness techniques
7. Use referencing as back-up navigation
8. Demonstrate adequate anti-silting techniques
9. Simulate a primary light failure, and deploy back up light and follow guideline to exit cavern
10. Demonstrate rebreather unit specific skills in compliance with current level of rebreather certification as outlined in the TDI course curriculum

Note: No removal of life support equipment shall be permitted within the overhead Environment

In order to complete this course, students must

1. Perform all land drills and rebreather cavern dive requirements safely and efficiently
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Maintain an appropriate level of awareness and respect for the cavern environment
4. Log all dives

39. Rebreather Introductory Cave Diver

39.1 Introduction

This course is an introduction to the basic principles of rebreather cave diving utilizing a single primary guide line. The TDI Rebreather Introductory Cave Diver is the second level in the development of safe techniques for rebreather cave diving, directly building upon the TDI Rebreather Cavern Diver course. This introduction to cave diving is not intended to train divers for all facets of rebreather cave diving. The objective of this course is the perfection of skills taught in the TDI Rebreather Cavern Diver program, in addition to the adoption of additional techniques and procedures required for elementary rebreather cave dives.

39.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in single guideline rebreather cave diving activities without direct supervision provided the graduates adhere to the following limits:

1. Diver carries adequate bailout to safely exit from the furthest point of penetration using a minimum SAC rate of 30 litres per minute/1 cubic foot per minute OR the student's calculated elevated SAC rate to account for a CO_2 event, whichever is greater
2. 40 metres / 130 feet maximum depth
3. No decompression diving
4. Maintain a continuous guideline (no jumps, no gaps)
5. Proper cave diving equipment is used in conjunction with a TDI approved rebreather

Upon successful completion of this course, graduates are qualified to enroll in:

6. TDI Rebreather Full Cave course

39.3 Who May Teach

1. Any active TDI Rebreather Full Cave Diver Instructor qualified to teach on the rebreather used may teach this course

39.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Open Water

1. A maximum of 3 students per active TDI Instructor are allowed
2. The ratio should be reduced as required due to environmental or operational constraints

Cave Dives

1. A maximum of 3 students per active TDI Instructor are allowed
2. The ratio should be reduced as required due to environmental or operational constraints

39.5 Student Prerequisites

1. Minimum age 18
2. Minimum certification requirement; TDI CCR Air Diluent Diver or equivalent
3. Provide proof of certification as a:
    a. TDI Rebreather Cavern Diver or equivalent

    OR

    b. TDI Introductory Cave Diver or equivalent
4. Provide proof of a minimum of 50 logged dives and 30 hours on the rebreather unit used

39.6 Course Structure and Duration

Water Execution

1. One open water evaluation dive *must* be conducted if students are new to the instructor or a period of 6 months has passed since their last cavern dive.
2. Minimum of 4 single guideline cave dives with a total bottom time of 160 minutes conducted at 2 different sites
3. Only 2 dives from the TDI Introductory Rebreather Cave Diver course may be credited towards the total dives required for TDI CCR Air Diluent Decompression Procedures course

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 4
2. Course must be taught over a minimum of 2 days

39.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption of Risk* Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the *TDI Diver Registration* Form or registering the students online through member's area of the TDI website

39.8 Required Equipment

The following are required for this course:

1. *TDI Diving in Overhead Environments* Manual
2. *TDI Diving in Overhead Environments* Instructor Guide
3. *TDI Diving in Overhead Environments* Instructor Resource CD (Optional)
4. *TDI Diving Rebreathers* Student Manual
5. *TDI Diving Rebreathers* PowerPoint Presentation (optional)
6. CCR Manufacturer's manual and updates
7. Manufacturer's Build Checklist
8. *TDI CCR Preflight Checklist*

Other suggested reading materials:

1. *NACD Art of Safe Cave Diving*
2. *Basic Cave Diving – A Blueprint for Survival*
3. *CDAA - Cavern / Sinkhole* Manual
4. *NSS-CDS Cave Diving* Manual
5. *The Darkness Beckons* – Martyn Farr
6. *Cavern Measureless to Man*

The following equipment is required for each student:

1. A complete TDI approved Rebreather
2. Minimum of 1 rebreather enabled computer or PO_2 monitoring device
3. Off board bailout cylinder(s) – volume appropriate for planned dive
4. Bailout regulator(s) equipped with pressure gauge and low pressure off board (quick connect) gas supply hose
5. Buoyancy compensator device (BCD) with power inflator
6. Exposure suit adequate for diving environment
7. Access to an oxygen analyzer (instructor may supply)
8. Mask and fins
9. Minimum of 2 cutting devices
10. Slate and pencil
11. Three battery powered lights; 1 primary and 2 back-ups, each with a with burn time suitable for the planned dive time
12. Safety reel with a minimum of 37 metres / 125 feet of guideline
13. One primary cave-diving reel with length appropriate for intended dive
14. Computer, watch or bottom timer and depth gauge
15. Slate or wet notes with a pencil
16. Submersible dive tables or backup dive computer
17. Three directional line arrows

Instructor must use full cave diving equipment during all water exercises

39.9 Required Subject Areas

The following topics must be covered during this course:

1. Policy for Cave Diving
2. Psychological Considerations
3. Equipment Considerations
    a. Bailout cylinder options
        i. Single bailout cylinder vs redundant
        ii. Long hose vs short hose on bailout
    b. Rebreather configuration options
    c. Scrubber options
    d. Buoyancy compensator device (BCD) / harness options
    e. Reel options
    f. Proper weighting
    g. Equipment configurations
4. Communication
    a. Hand signals
    b. Light signals
    c. Touch contact signals
5. Swimming Techniques
    a. Body posture/ trim
    b. Buoyancy control and rebreather weighting
    c. Line following
    d. Propulsion techniques
6. Physiology
    a. Breathing techniques
    b. Stress management
7. Cave Environment
    a. Geology
        i. Bottom
        ii. Ceiling
    b. Local access requirements
    c. Land owner relations
8. Conservation
9. Problem Solving
    a. Emergency procedures
    b. Equipment failure
    c. Silting conditions
10. Accident Analysis
11. Review of Dive Tables and Decompression Theory

12. Cave Diving with Open Circuit Divers
    a. bailout equipment requirements
    b. out of air emergencies
13. Cave Diving Etiquette

39.10 Required Skill Performance and Graduation Requirements

At NO point is the student to be unable to monitor their PO2 while on the loop. Zero visibility drills must be performed in a way that the student may monitor the status of the breathing loop; i.e. no mask but able to monitor HUD, lights out but able to use display lighting to view PO2, etc. Or the drill must be done on bailout.

The following land drills must be covered during this course:

1. How to properly:
    a. Deploy a guideline
    b. Follow a guideline
    c. Conduct bail out exit including bottle swapping while following a guideline
    d. Conduct bail out exit including bottle swapping simulating zero visibility and using touch contact while following a guideline
2. Use of safety reel in:
    a. Lost diver procedures
    b. Lost line drill

The student must perform the following S-drill and skills during all dives:

1. Demonstrate:
    a. Adequate pre-dive planning
    b. Equipment check and equipment matching
    c. Bubble check
    d. Specialized propulsion techniques in varying types of flow
    e. Proper:
        i. Buoyancy control
        ii. Body posture
        iii. Stress analysis (detection and management)
        iv. Oxygen partial pressure management
        v. Overall rebreather instruments analysis

The student must perform the following in-water skills during cave dives:

1. Properly:
    a. Deploy a guideline
    b. Use line markers
    c. Follow a guideline

   d. Follow a guideline simulating loss of visibility
2. Perform bailout exit practicing bottle swapping with teammates, following the guideline
3. Perform bailout exit practicing bottle swapping with teammates simulating zero visibility and using touch contact, following the guideline
4. Remove and replace mask while in contact with guideline
5. Demonstrate light / hand signals and touch contact
6. Conservation and awareness techniques
7. Using referencing as back-up navigation
8. Demonstrate adequate anti-silting techniques
9. Simulate a primary light failure, and use back-up light to exit the cave
10. Demonstrate lost line drills using instrumentation lighting only
11. Demonstrate lost diver drills
12. Demonstrate rebreather unit specific skills in compliance with current level of rebreather certification as outlined in the TDI course curriculum

In order to complete this course, students must:

1. Satisfactorily complete the TDI Introductory Cave Diver Course written examination
2. Perform all land drills and cave dive requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution
4. Maintain an appropriate level of awareness and respect for the cavern environment
5. Log all dives

40. Rebreather Full Cave Diver

40.1 Introduction

This course is the third stage of training in the series of TDI's Rebreather Cave Diver development program. Advanced rebreather cave dive planning, the practical execution of different types of cave systems and scenarios divers encounter are presented. This rebreather cave diving course is not intended to prepare divers for evaluating all facets of cave diving. The objective of this course is to expand and critique previous skills accomplished in the TDI Rebreather Cavern Diver and Rebreather Introductory Cave Diver programs. Emphasis is placed upon dive planning and skill perfection through actual cave penetration.

40.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in cave diving activities without direct supervision provided the graduates adhere to the following limits:

1. Diver carries adequate bailout to safely exit from the furthest point of penetration and complete any decompression stops using a minimum SAC rate of 30 litres per minute/1 cubic foot per minute OR the student's calculated elevated SAC rate to account for a CO_2 event, whichever is greater
2. 45 metres / 150 feet maximum depth
3. No equipment removal in cave
4. Complete safety and decompression stops as appropriate or necessary
5. Maintain a continuous guideline
6. Proper cave diving equipment is used in conjunction with a TDI approved rebreather

40.3 Who May Teach

This course may be taught by any active TDI Rebreather Full Cave Diver Instructor qualified to teach on the rebreather being used.

40.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Open Water

1. A maximum of 3 students per active TDI Instructor are allowed
2. The ratio should be reduced as required due to environmental or operational constraints

Cave Dives

1. A maximum of 3 students per active TDI Instructor are allowed
2. The ratio should be reduced as required due to environmental or operational constraints

40.5 Student Prerequisites

1. Minimum age 18
2. Certified TDI CCR Air Diluent Decompression Procedures Diver certification or equivalent
3. Provide proof of certification as a:
    a. TDI Rebreather Introductory Cave Diver or equivalent
    OR
    b. TDI Full Cave Diver or equivalent
4. Provide proof of a minimum of 50 logged dives and 50 hours on the rebreather unit used

40.6 Course Structure and Duration

Water Execution

1. Eight cave dives are required with a minimum accumulated bottom time of 360 minutes at 3 different sites
5. At least 1 of these sites should be a location not utilized in training during the cavern or introductory cave courses
6. At least 2 dives must be at least 60 minutes long

Course Structure

2. TDI allows instructors to structure courses according to the number of students participating and their skill Level

Duration

2. The suggested number of classroom and briefing hours is 6
3. Course must be taught in no less than 4 days

40.7 Administrative Requirements

The following is the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment and certifications
3. Communicate the training schedule to the students
4. Have the students complete the:
    a. *TDI Liability Release and Express Assumption* of Risk Form
    b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the *TDI Diver Registration* Form or registering the students online through member's area of the TDI website

40.8 Required Equipment

The following are required for this course:

1. *TDI Diving in Overhead Environments* Manual

2. *TDI Diving in Overhead Environments* Instructor Guide
3. *TDI Diving in Overhead Environments* Instructor Resource CD (Optional)
4. *TDI Diving Rebreathers* Student Manual
5. *TDI Diving Rebreathers* PowerPoint Presentation (optional)
6. CCR Manufacturer's manual and updates
7. Manufacturer's Build Checklist
8. *TDI CCR Preflight Checklist*

Other suggested reading materials:

1. *CCR Cave Almost Simplified*- Mel Clark
2. *NACD Art of Safe Cave Diving*
3. *Basic Cave Diving – A Blueprint for Survival*
4. *CDAA - Cavern / Sinkhole* Manual
5. *NSS – CDS Cave Diving* Manual
6. *Cavern Measureless to Man*
7. *The Darkness Beckons* – Martyn Farr

The following equipment is required for each student:

1. A complete TDI approved rebreather
2. Minimum of 1 rebreather enabled computer or PO_2 monitoring device redundant off board
3. Off board bailout cylinder(s) – volume appropriate for planned dive
4. Bailout regulator(s) equipped with pressure gauge and low pressure off board (quick connect) gas supply hose.
5. Buoyancy compensator device (BCD) with power inflator
6. Exposure suit adequate for diving environment
7. Access to an oxygen analyzer (instructor may supply)
8. Mask and fins
9. Minimum of 2 cutting devices
10. Slate and pencil
11. Three battery powered lights; 1 primary and 2 back-ups, each with a with burn time suitable for the planned dive time
12. Safety reel with a minimum of 37 metres / 125 feet of guideline
13. Gap reel with 15 metres / 50 feet of guideline
14. One primary cave-diving reel with length appropriate for intended dive
15. Computer, watch or bottom timer and depth gauge
16. Slate or wet notes with a pencil
17. Submersible dive tables or backup dive computer
18. Three directional line arrows
19. Three non-directional marker
20. Any staged decompression cylinders must be properly labeled

Instructor must use full cave diving equipment during all water exercises

40.9 Required Subject Areas

The following topics must be covered during this course:

1. Policy for Cave Diving
2. Psychological Considerations
3. Equipment Considerations
    a. Bailout cylinder options
        i. Single bailout cylinder vs redundant
        ii. Long hose vs short hose on bailout
    b. Rebreather configuration options
    c. Scrubber options
    d. Buoyancy compensator device (BCD) / harness options
    e. Reel options
    f. Proper weighting
    g. Equipment configurations
4. Communication
    a. Hand signals
    b. Light signals
    c. Touch contact signals
5. Swimming Techniques
    a. Body posture/ trim
    b. Buoyancy control and rebreather weighting
    c. Line following
    d. Propulsion techniques
6. Physiology
    a. Breathing techniques
    b. Stress management
    c. Decompression theory and its application to cave diving
7. Cave Environment
    a. Geology
        i. Bottom
        ii. Ceiling
    b. Local access requirements
    c. Land owner relations
8. Conservation
9. Problem Solving
    a. Emergency procedures
    b. Equipment failure

c. Silting conditions

10. Accident Analysis
11. Review of Dive Tables and Decompression Theory
12. Cave diving with Open Circuit divers
    a. Bailout configuration requirements
    b. Out of air emergencies
13. Cave Diving Etiquette

40.10 Required Skill Performance and Graduation Requirements

At NO point is the student to be unable to monitor their PO_2 while on the loop. Zero visibility drills must be performed in a way that the student may monitor the status of the breathing loop; i.e. no mask but able to monitor HUD, lights out but able to use display back light to view PO2, etc. Or, the drill must be done on bailout.

The following land drills must be covered during this course:

1. How to properly:
    a. Deploy a guideline
    b. Follow a guideline
    c. Conduct bail out exit including bottle swapping while following a guideline
    d. Conduct bail out exit including bottle swapping simulating zero visibility and using touch contact while following a guideline
2. Use of safety reel in:
    a. Lost diver procedures
    b. Lost line drill

The student must perform the following S-drill and skills during all dives:

1. Demonstrate adequate pre-dive planning
2. Equipment check and equipment matching
3. Bubble check
4. Demonstrate:
    a. Specialized propulsion techniques in varying types of flow
    b. Proper:
        i. Buoyancy control
        ii. Body posture
        iii. Stress analysis (detection and management)
        iv. Oxygen partial pressure management
        v. Overall rebreather instruments analysis

The student must perform the following in-water skills during cave dives:

1. Properly:

   a. Deploy a guideline
   b. Use directional and non directional line markers
   c. Follow a guideline
   d. Follow a guideline simulating loss of visibility
2. Perform bailout exit practicing bottle swapping with teammates:
   a. Following the guideline
   b. Simulating zero visibility and using touch contact, following the guideline
3. Remove and replace mask while in contact with guideline
4. Demonstrate light / hand signals and touch contact
5. Execute conservation and awareness techniques
6. Use referencing as back-up navigation
7. Demonstrate adequate anti-silting techniques
8. Simulate a primary light failure, and use back light to exit the cave
9. Demonstrate lost line drills using instrumentation lighting only
10. Demonstrate lost diver drills
11. Demonstrate to use of reels to perform jumps and gaps required in circuits and traverses to maintain a continuous guideline to open water
12. Exit the cave flying the rebreather in SCR mode
13. Exit the cave simulating solenoid failure (if applicable)
14. Demonstrate advanced navigation techniques including a minimum of:
   a. 4 jumps
   b. 2 circuits
15. Demonstrate rebreather unit specific skills in compliance with current level of rebreather certification as outlined in the TDI course curriculum

In order to complete this course, students must:

1. Satisfactorily complete the TDI Cave Diver Course written examination
2. Perform all land drills and cave dive requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution
4. Maintain an appropriate level of awareness and respect for the cavern environment
5. Log all dives